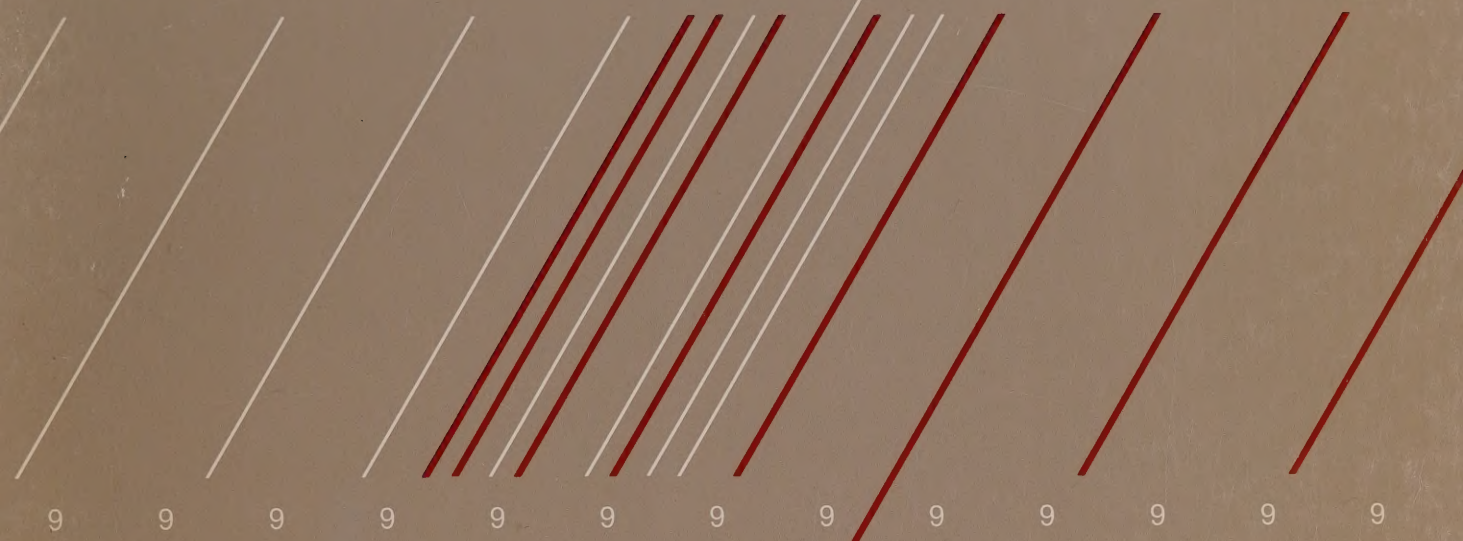
The Ontario Task Force on Employment and New Technology



Employment and New Technology in the Communications Equipment Industry

An Appendix to the Final Report

ONTARIO TASK FORCE ON EMPLOYMENT AND NEW TECHNOLOGY

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APPENDIX 9

EMPLOYMENT AND NEW TECHNOLOGY

IN THE COMMUNICATIONS EQUIPMENT INDUSTRY

This Appendix contains a report prepared for the Ontario Task Force on Employment and New Technology. The topic was approved in advance by the Task Force. At the conclusion of the study, the Task Force had the opportunity to review the report, but its release does not necessarily imply endorsement of the results by the Task Force or its individual members.

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FOREWORD

The Ontario Task Force on Employment and New Technology, a joint labour-management group, was established in May, 1984, "to consider and report on the manpower and employment implications of new technologies as the same may be introduced and applied in Ontario during the next decade and the extent and nature thereof."

To inform its discussions, the Task Force established a research agenda designed to gather information on employment and technological change from a wide variety of sources. The research agenda contained projects which gathered information of a historical nature, and projects with a future orientation which were designed to gather information describing likely occupational and employment implications associated with technological change in the 1985-1995 period.

The Appendices to the Final Report of the Ontario Task Force on Employment and New Technology contain reports of these research projects. A complete list of these Appendices may be found at the end of this document.

Among the Appendices are reports of a series of studies to assess the extent and nature of the employment implications of new technology in selected industries in Ontario. Appendix 3 describes the process by which the industries were selected, and contains the studies' terms of reference which called for particular attention to selected new technologies and occupational groups. Appendices 4-18 contain reports of these industry studies, which were conducted by Currie, Coopers & Lybrand, management consultants.

This particular appendix contains a report of the study on the Communications Equipment Industry.

Dr. Richard L. E. Brown, P.Eng.
Research Director

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The Board of Industrial Leadership and Development (BILD) of the Government of Ontario.

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The Task Force would like to thank the staff of Currie, Coopers & Lybrand, particularly Maureen Farrow and Victor Rocine, whose assistance in the conduct of this study is greatly appreciated.

Special thanks are due to all industry experts and survey respondents who provided information for this study.

EMPLOYMENT AND NEW TECHNOLOGY IN THE COMMUNICATIONS EQUIPMENT INDUSTRY

A Report Prepared by Currie, Coopers & Lybrand
for the Consideration of the Ontario Task Force
on Employment and New Technology

July 1985

Submitted By: Maureen Farrow
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PART I - INTRODUCTION AND METHODOLOGY

1.0 INTRODUCTION

This report is one of a series of industry reports which summarize the findings of a major research project[1] undertaken for the Ontario Task Force on Employment and New Technology. Each report includes a historical analysis and an outlook to 1995 for the industry, and a review of the anticipated impacts of new technology on employment.

1.1 Structure of This Report

This report presents the study findings for Ontario's Communications Equipment Industry (SIC 335)[2]. The report includes four parts.

- The first part (Chapter 1.0) is the Introduction which includes a description of the approach and methodology.

- The second part (Chapter 2.0) is a Historical Analysis for the industry from 1971 to 1984 which provides background and a perspective on the industry's historical development.

- The third part (Chapters 3.0 to 7.0) discusses the results of the survey of firms in the industry and incorporates the interview findings with industry experts. These chapters cover:

  - a review of recent and anticipated technology adoptions,

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1 Manpower and Employment Implications of New Technologies in Selected Manufacturing Industries in Ontario to 1995. The terms of reference of this assignment can be found in Appendix 3 to the Task Force's final report.

2 1970, Standard Industrial Classification (SIC), Statistics Canada.

- the outlook for the industry to 1995, including expected output and employment levels,

- effects on employment of new technology such as anticipated occupational shifts and changes in required skills,

- a review of the labour relations environment as it relates to new technology, and

- observations on planning efforts for technological change in the industry.

- Part four of the report includes various appendices that support the text of individual chapters.

1.2 Study Approach

The study approach selected incorporates the following research techniques:

- analysis of published statistics and reports on the industry, augmented by the working knowledge of industry specialists within Currie, Coopers & Lybrand,

- in-depth interviews with management and labour experts in the industry, conducted at various stages in the project, using structured interview guides, and

- an industry survey.

The reasons for the choice of these techniques are explained below.

1.2.1 Historical Analysis

The purpose of the historical analysis was to provide an informed perspective on the industry from which to view future trends. The historical analysis covers: the economic environment, competitive factors, output and employment patterns, productivity, technology adoption and the industrial relations environment. In order to permit cross industry analysis, consistent indicators and data sources were used.

1.2.2 Expert Interviews

At various stages in the project, a series of in-depth interviews were conducted with industry leaders, industry associations and union representatives. These experts have a broad understanding of the industry in terms of both its historical development and its future outlook. Their input assisted in the preparation of the historical analysis and in the survey design, and facilitated a clearer interpretation of the survey results.

1.2.3 Sample Survey of Firms

The following describes the key features of the survey.

Ontario firms in the Communications Equipment Industry were identified using the 1982 Census of Manufacturers.[1] All firms with twenty or more employees were included in the sample frame. Employment in these firms is estimated to include 99 percent of the 28,090 employees (1982) in the Communications Equipment Industry in Ontario.

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1 Manufacturing Industries of Canada: National and Provincial Areas, 1982, Statistics Canada, Catalogue No. 31-203.

The total number of firms in the industry in 1982 was 80, of which 65 had twenty or more employees. This latter group of firms, with twenty or more employees, was the base for selecting a sample of firms for the survey. Table 1, below, shows the number of firms in the sample frame, by size.

A representative, random sample of firms, stratified by employment size categories (see Appendix A), was chosen from the sample frame. The senior executive officer of each firm was identified and a structured questionnaire was sent to this individual.

A search was carried out of the Ontario Ministry of Labour Collective Agreements Library to identify unions in the sample firms. Union head offices were contacted to identify the appropriate union leader in each of the unionized firms in the sample. The same questionnaire was sent to union representatives. A copy of the survey questionnaire is attached as Appendix B together with an outline of the number of responses by question.

Consultants provided ongoing assistance to respondents, both on the telephone and in person, to complete the questionnaires. The questionnaire survey process generally ended with a personal interview. The number of firms and unions who participated in the sample survey are shown in the table.

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1 The number of firms should not be confused with the number of establishments (263 in 1982). Establishments are production centres. Therefore, a firm may have more than one establishment.

TABLE 1: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Number of Firms and Unions Responding
By Firm Employment Size

Firms by Employment Size	Firms	Unions	Firms in Sample Frame (1)
Small (20-99)	2	0	31
Medium (100-499)	6	0	24
Large (500+)	4	2	10
Total Firms	12	2	65

(1) SOURCE: Statistics Canada, CENSUS OF MANUFACTURERS, 1982.

In most cases, several participants in each organization contributed to the completion of a questionnaire. In the Communications Equipment survey, an average of 2.8 participants contributed to a firm questionnaire and 1.0 participants to a union questionnaire. The companies' principal participants had an average of 9 years' experience with their firms and 19 years in the industry. The union's principal participant had 20 years experience with the industry.

The sample survey results have been weighted up to the number of firms in the sample frame. That is, the survey results reported herein refer to the weighted survey results and are, therefore, representative of firms with 500 or more employees in the Communications Equipment Industry (SIC 335) in Ontario. Reliability of the sample is estimated at 90 percent, with an 11 percent allowable error. See Appendix C for an explanation of the sample reliability calculation method.

> Readers should be cautioned about the nature and reliability of the sample survey results. The questionnaire included a set of questions asking respondents about the future (i.e., five and ten years ahead) from a particular point in time. The results are, therefore, a representative sample of views about, and expectations for, the future and should not be viewed as what will necessarily take place. The survey provides a useful perspective from which to better understand how the industry perceives the future of new technology adoption and its anticipated impacts on employment.

The next chapter of the report discusses the historical analysis and subsequent chapters review the results of the sample survey and expert consultation which discuss the anticipated trends for the period 1985 to 1995.

PART II - HISTORICAL TRENDS 1971-1984

2.0 INTRODUCTION

This section of the report provides an historical analysis of trends in the Communications Equipment Industry for the period 1971 to 1981 and 1982 to 1984. The Communications Equipment Industry in Ontario includes 263 establishments that shipped products worth $1.8 billion and employed 28,090 people in 1982. Ontario accounted for 59.5 percent of Canadian shipments by the communications equipment industry in 1982 and 59.4 percent of Canadian establishments. About 44 percent of Ontario's production of communications equipment was exported, mainly to the United States, in 1982.

2.1 The Structure of the Industry

The Communications Equipment Industry includes establishments such as Litton Systems (Canada) Limited, Microtel Limited, Leigh Instruments Limited and Northern Telecom Ltd. These and other establishments in the Communications Equipment Industry are primarily engaged in manufacturing radio and television transmitters, radar equipment, closed circuit television equipment, electronic navigational aids, public address apparatus, and the related parts and equipment. Included also are establishments primarily engaged in manufacturing telephone and telegraph equipment and parts, or electric and electronic signalling apparatus. As well, this industry includes establishments primarily engaged in manufacturing electronic control panels and similar devices. Finally, repair and overhaul of electronic equipment, except household equipment, is classified in SIC 335.

Not included in the Communications Equipment Industry are establishments that are primarily engaged in other manufacturing activities but also maintain communications equipment

manufacturing facilities. These establishments are classified elsewhere because communications equipment is not their major field of activity.

Table D.1 lists the major products of the Communications Equipment Industry in order of importance. The tables for this section of the report are presented in Appendix D, Historical Tables. Telephone equipment is the largest product category of SIC 335, representing 24.0 percent of industry shipments in 1981. Electronic equipment components and radio communication equipment are the next largest product categories, accounting for 9.1 percent and 8.8 percent of shipments respectively in 1981. The large proportion of shipments (45 percent) explained by the all other products category in Table D.1 indicates that the industry manufacturers a wide variety of products not listed. Some of these products are custom designed for individual markets or customers. Others, such as burglar systems or cable television (CATV) active equipment are mass produced but are included here because of the relatively small value of shipments in 1981.

2.2 The Market Environment

The communications equipment manufacturing sector is dominated by companies supplying telephone equipment, electronic components, radio communications equipment and associated electronic, electrical, radar, sonar and broadcasting equipment. The entire sector has been heavily influenced by the introduction and growth of microchip technology over the last ten years and this, with other changes described below, altered the way in which the industry is structured. Consequently, the sector has become technology-driven and those companies that made significant development investments in the right areas are now reaping the rewards of their foresight. An example of this is the DMS product line introduced by Northern Telecom as a result of the development work completed by its 70 percent owned subsidiary, Bell Northern Research.

A further important environmental factor is the legislative and regulatory changes which influence the scope and accessibility of the markets served by this sector. Thus, Northern Telecom's DMS technology coincided with the divestiture of American Telephone and Telegraph Company in the United States and this timely change allowed it to consolidate a formidable bridgehead in that country lending to its present very strong position.

This underlines a third dimension of the marketplace - the international nature of the industry. The technology is too complex and pervasive to be considered in a domestic sense. The vast amount of money which must be spent on research and development requires that a worldwide market be sought.

A fourth, coincidental trend over the last ten years has been the gradual convergence of the three major technologies at use in the office i.e., the data processing, office products and communications technologies. The communications industry is the one which enables the other two technologies to be connected to provide a fully integrated office. As this trend has grown, the importance of new telecommunications technologies in offices has been recognized. Thus, private branch exchange (PBX) switches which can handle both voice and data have been designed and introduced in most offices. This has signalled the introduction of digital as well as analog telephone switches enabling voice and data exchange using a single telephone line.

Because of these trends during the 1970's and early 1980's, this sector experienced high growth rates despite the economic upheavals of that time. And the continued increase of text and data have maintained investment confidence in this sector through this period and for the future. Communications exchange is at the heart of this revolution and will continue to be "the glue" which binds the various technologies together.

In the Canadian and Ontario context, one company dominates. As already mentioned, Northern Telecom Limited has made the right moves at the right times and is now larger than the whole Canadian domestic market combined. It supplies approximately two-thirds of the Canadian equipment market, and, as a subsidiary of Bell Canada, it has a ready-made outlet for its product domestically. This is a significant relationship - the market forces in the 1970's increased the high degree of vertical integration in the sector; other examples of one relationship are between British Columbia Telephone (B.C. Tel) and Microtel (formerly AEL Microtel) and the Alberta Government Telephone (AGT) and Novatel. In each case, the equipment manufacturer is either a subsidiary of the telephone company or has a connecting relationship with the parent company of both concerns.

Because of the international nature of the marketplace, equipment manufacturers operated with marginal effectiveness during the 1970's. Domestically, they were also constrained by a highly regulated policy environment which prohibited private concerns from purchasing communications equipment. Because of the size and nature of the Canadian market, manufacturers were limited to the relatively small sales volumes and did not enjoy much success in exporting their goods.

In the same time period, however, Northern Telecom experienced a decade of phenomenal growth. It quadrupled consolidated sales, net earnings increased tenfold, and the number of plants owned increased from 12 in 1970 to 55 by 1980. This success was built largely on its penetration of the U.S. market where it now commands about 16 percent of PBX sales compared to that of 24 percent by AT&T, 14 percent by ROLM and 11 percent by Mitel.

A further stimulant during the 1970's was the increasing awareness by major corporation of their communications costs. This led them to create their own privately operated data networks which linked up with public telecommunications networks.

The first examples of these trends were highly specialized and large applications such as airline reservation systems. Data networks were then increasingly used for general purpose communications exchange by the late 1970's. A driving force in this change was the growth of distributed data processing which utilized dispersed processing power and the trend from large individual computers towards smaller decentralized systems. The changing technology which assisted this was the introduction and growth of mini computers which businesses quickly made full use of to lower their computing costs and to place data processing closer to data sources. This then evolved toward linking these mini computers and other computers up into private networks and larger distributed systems.

By 1979, the Canadian Radio-Television and Telecommunications Commission (CRTC) allowed private concerns to buy their own equipment rather than renting from local telephone companies. This applied in Ontario as well as Quebec and British Columbia and smaller companies like Mitel Corporation grew explosively as a result. The change in regulations also allowed other companies like Northern Telecom and Microtel to sell directly to consumers and to customize the equipment to their specific needs. Thus, the marketplace changed in a very fundamental structural sense and, as deregulation continues, more marketing freedom to these companies, and their competitors, will result.

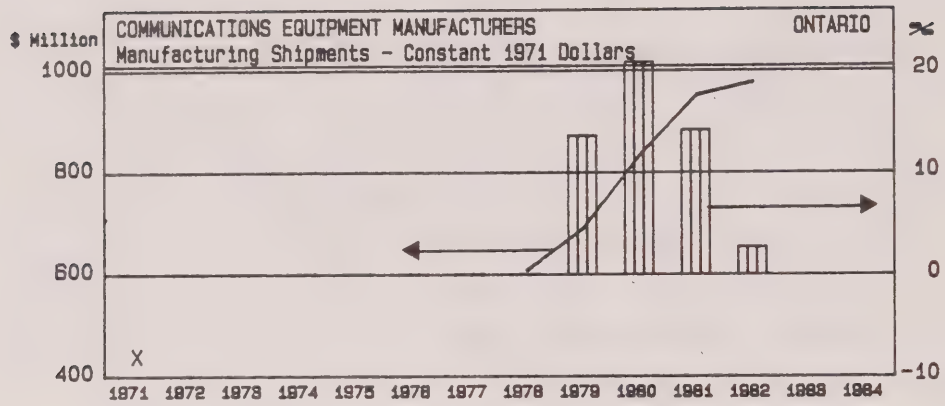
Thus, this dynamic sector required large investments in research and development to fuel the critically important technological advances. The combination of shrewd research and development investment, favourable legislation, cost effective production and good marketing were fundamental to success in the last decade in this internationally competitive sector.

2.3 Industry Trends

Tables D.2 to D.5 present key industry indicators for the years 1971 to 1984.

2.3.1 Aggregate Output

EXHIBIT 1



X 1971. Intervening years 1972 to 1977 not available. For explanation, refer to Table D.2.

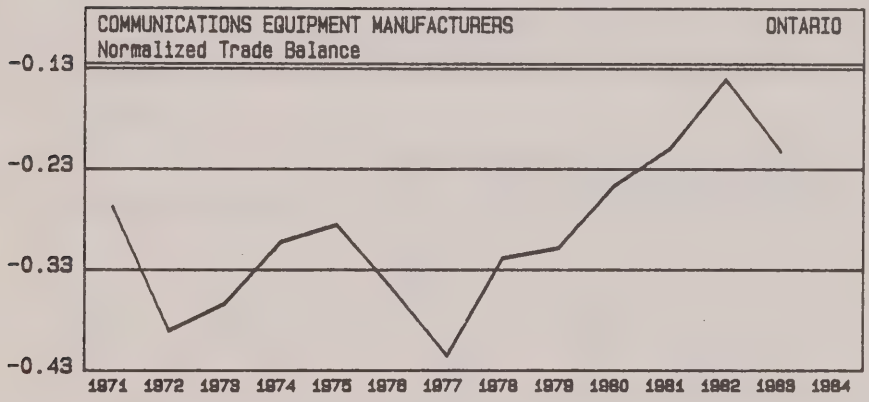
Manufacturing shipments of the Communications Equipment Industry in Ontario increased from $426.9 million in 1971 to $1,711.8 million in 1981 in current dollars. In constant 1971 dollars, manufacturing shipments increased from $426.9 million to $950.5 million from 1971 to 1981, averaging an annual rate of increase of 8.3 percent. Constant dollar shipment data is not available for the years 1972 through 1977, thus little is known about the fluctuations in constant dollar growth rates over the early 1970's. Data for the latter years of the 1970's indicates, however, that growth was particularly rapid - averaging annual rates of increase of 16.2 percent from 1978 to 1981.

In 1982, constant dollar growth in shipments levelled off somewhat. Constant 1971 dollar shipments in the Communications Equipment Industry increased to $976.0 million in 1982 - a 2.7 percent increase over 1981 levels of $950.5 million. In current dollars, manufacturing shipments rose 6.3 percent from $1,711.8 million in 1981 to $1,819.2 million in 1982.

2.3.2 Competitive Position

In 1971, Ontario imported $187.6 million of communications equipment. Imports in current dollars increased to $1,091.3 million in 1981 before falling off by 2.5 percent in 1982 in response to the continuation of the 1981-1982 economic recession in Canada. In 1983, current dollar imports increased again by 18.8 percent to $1,264.3 million.

EXHIBIT 2

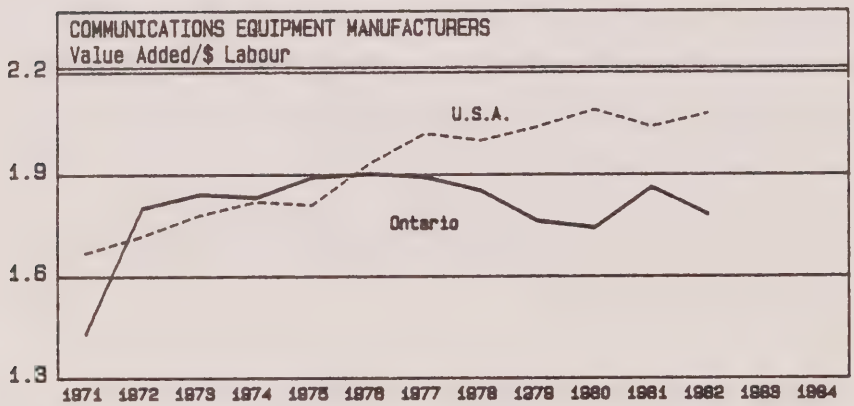


Since 1971, the value of Ontario's exports of communications equipment has been less than the value of imports. In 1971, Ontario exported $108.2 million of communications equipment. By 1981, exports had increased to $712.0 million. Exports continued to increased in 1982 and 1983 as the United States economy recovered from the 1981-1982 economic downturn. By 1983, Ontario's exports of communications equipment were $820.8 million compared to $1,264.3 million of imports.

Ontario's normalized trade balance (exports minus imports divided by exports plus imports) reflects Ontario's negative trade balance in communications equipment. The normalized trade balance gradually trended upward from a 1977 low of -0.416 to a peak of -0.141 in 1982. The upward trend over these years indicated that Ontario's negative trade balance as a percent of total trade was declining.

In 1983, an 18.8 percent increase in the value of imports combined with a smaller 2.3 percent increase in the value of exports caused a decline in Ontario's normalized trade balance from peak 1982 levels.

EXHIBIT 3



The performance of Ontario's Communications Equipment Industry can be compared to the counterpart industry in the United States based on an analysis of value added per dollar of labour. A declining ratio indicates that labour has become an increasingly large portion of value added. By implication, an increasing ratio indicates that capital has become an increasingly large portion of value added.

In Ontario, value added per dollar of labour was slightly higher than in the United States in the period from 1972 through 1975. From 1976 to 1980, value added per dollar of labour experienced year over year increases in the United States while in Ontario value added per dollar of labour gradually declined. As a result, the gap between the United States and Ontario widened over the period with the United States outperforming Ontario by a sizeable margin.

In 1981, value added per dollar of labour increased from $1.74 to $1.86; in the United States, value added per dollar of labour declined from $2.09 to $2.04. Although the gap between the two regions narrowed in 1982, the reverse occurred in 1983 as Ontario once again lost ground.

2.3.3 Capital Investment

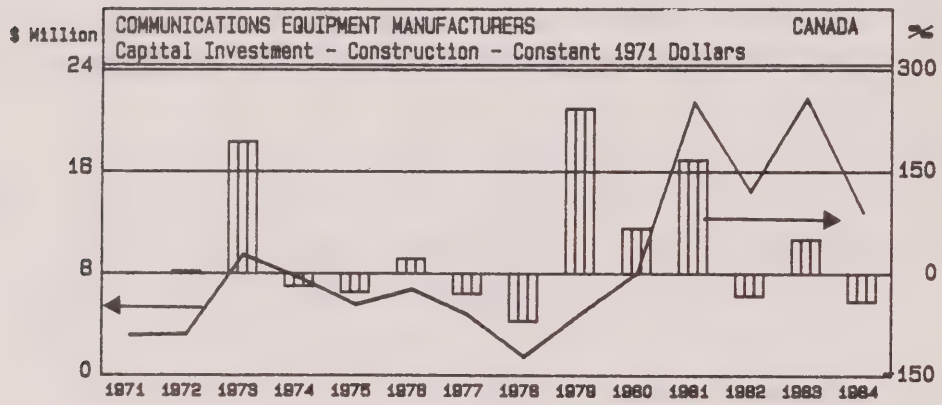
Capital investment statistics are only available for Canada as a whole for SIC 335; however, in 1982, Ontario based manufactures of communications equipment accounted for 59.5 percent of Canadian shipments of these products.

Total capital investment by the Communications Equipment Industry in Canada increased from $27.1 million in 1971 to $185.1 million in 1981. From 1982 to 1984, total capital investment increased from $178.2 million to an expected $271.8 million in 1984.

In constant 1971 dollars, total capital spending by the Communications Equipment Industry in Canada increased from $27.1 million to $75.9 million from 1971 to 1981, averaging an annual rate of increase of 10.8 percent over the period. From 1982 to 1984, constant dollar capital

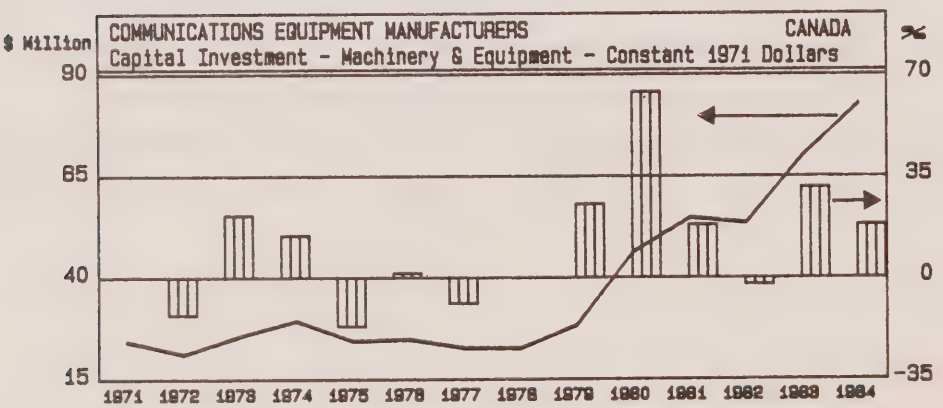
investment will average an expected annual increase of 18.8 percent from depressed 1982 levels of $67.6 milliom to $95.4 million in 1984.

EXHIBIT 4



Annual capital expenditures on construction have traditionally been less than those on machinery and equipment by the communications equipment industry. From 1971 to 1981, current dollar capital spending on construction increased from $3.1 million to $53.1 million while the corresponding numbers for capital spending on machinery and equipment were $24.0 million and $132.0 million. On a constant 1971 dollar basis, capital spending on construction increased at a more rapid average annual rate of 21.3 percent compared to average annual increases of 8.5 percent for machinery and equipment spending from 1971 to 1981.

EXHIBIT 5



From 1982 to 1984, current dollar capital spending on construction declined from a low of $39.1 million in 1982 to an expected $37.5 million in 1984 despite a strong upturn in 1983. Current dollar capital spending on machinery and equipment meanwhile increased from $139.1 million to an expected $234.3 million from 1982 to 1984. In 1984, constant 1971 expenditures on construction are expected to be $12.8 million compared to $14.4 million in 1982, $21.4 million in 1981 and $3.1 million in 1971. Similarly, constant 1971 dollar expenditures on machinery and equipment are forecast at $82.6 million in 1984 compared to $53.2 million in 1982, $54.5 million in 1981 and $24.0 million in 1971.

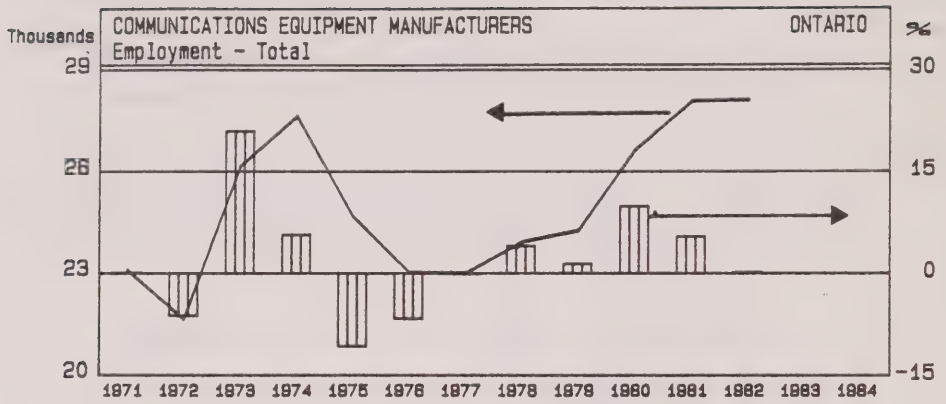
2.3.4 Employment

The discussion of employment includes an analysis of aggregate trends and occupational analysis of aggregate trends and occupational changes.

- Aggregate Trends

  In this report two sources of employment data are used in order to provide the level of analysis required. Total employment trends are taken from Statistics Canada, Manufacturing Industries of Canada: National and Provincial Areas, Cat. No. 31-203. This data series is based on the Census of manufacturing industries conducted by Statistics Canada annually. This data series is used as its shows the year to year trend in total employment. In order to analyze the employment trends by occupation, the Census of Canada has been used. However, this data is only available for the census years 1971 and 1981. These two series differ because of differences in coverage and methodology and this should be noted.

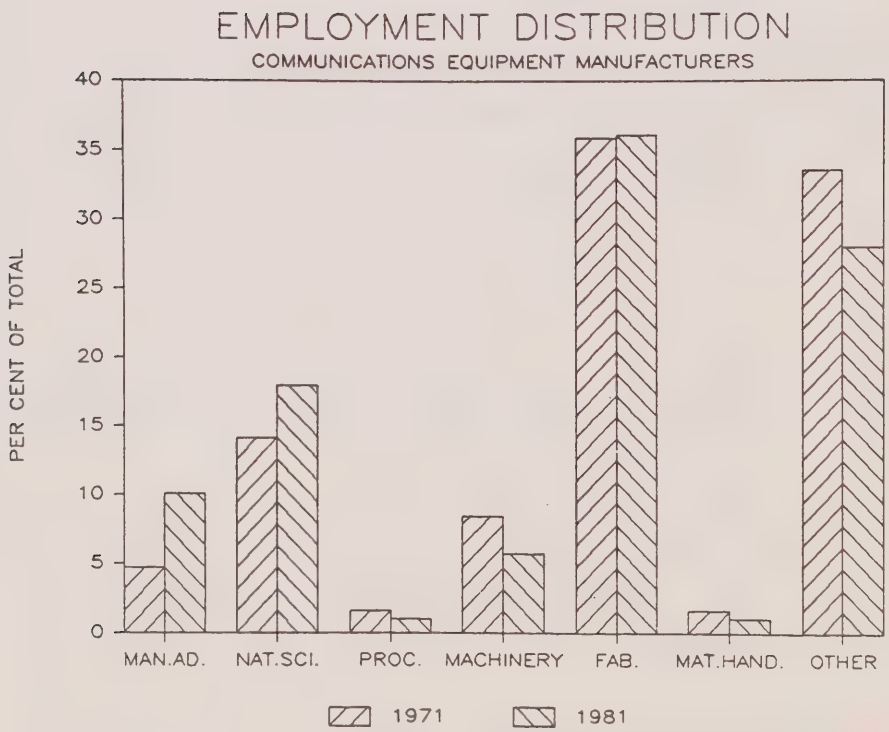
EXHIBIT 6



In 1982, 28,090 persons were employed in SIC 335 in Ontario compared to 28,059 in 1981 and 23,057 in 1971. Total employment in the Communications Equipment Industry in Ontario increased at an average annual rate of 2.0 percent over the 1971 to 1981 period and held steady in 1982.

- Occupational Changes

EXHIBIT 7



Census data for Ontario show that total employment in the Communications Equipment Industry increased at an average annual rate of 2.8 percent from 1971 to 1981. Exhibit 7 illustrates that three of the seven occupational groups increased in importance over the decade. Employment in the Processing, Machining and Related, Material Handling and Related and All Other categories declined as a percent of total employment from 1971 to 1981. Almost half of the Other category was made up of clerical workers in 1981.

The Managerial, Administrative and Related occupational groups experienced the most rapid average annual increases in employment of 10.8 percent from 1971 to 1981. This employment category accounted for 3,030 jobs or 10.1 percent of total employment in SIC 335 in 1981.

The Material Handling and Related group experienced the strongest average annual declines in employment of 1.9 percent from 1971 to 1981. However, Material Handling and Related was amongst one of the smallest occupational groups in SIC 335 in 1981, accounting for 310 jobs or 1.0 percent of industry employment.

The largest occupational group in 1981, Product Fabricating, Assembling and Repairing, accounted for 10,830 jobs or 36.1 percent of total employment in SIC 335. This group grew at an average annual rate of 2.8 percent from 1971 to 1981. Likewise, the other major occupational group in SIC 335 - Natural Sciences, Engineering and Mathematics increased at a relatively strong average annual rate of 5.3 percent from 1971 to 1981. In 1981, this group accounted for 5,395 jobs or 18.0 percent of industry employment.

Analysis at the more detailed occupational level indicates that the personnel and industrial relations management and production management groups experienced the strongest average annual rates of increase at 38.5 percent and 22.8 percent respectively from 1971 to 1981. Despite these large increases in employment over the decade, employment in personnel and industrial relations management accounted for only 0.4 percent and employment in production management accounted for just over 2.0 percent of total industry employment in SIC 335 in 1981.

The most severe average annual declines in employment occurred in the electrical equipment fabricating and assembling occupation (5.5 percent) and the packaging, not elsewhere classified occupation (4.2 percent) from 1971 to 1981. Although the latter employment category was small, accounting for only 150 jobs or 0.5 percent of total employment in SIC 335 in 1981, the electrical equipment fabricating and assembling occupation was relatively larger, accounting for 1,025 jobs or 3.4 percent of employment in 1981.

The largest occupational category at the detailed level in SIC 335 was electronic equipment fabricating and assembling with 4,760 persons or 15.9 percent of total industry employment in 1981. This occupational group increased at an average annual rate of 6.0 percent from 1971 to 1981 - well above the industry average of 2.8 percent.

Analysis by sex in Table D.7 indicates that female employment increased from 41.6 percent to 42.5 percent of total industry employment from 1971 to 1981. Nearly 3,300 jobs were attained by females over the period causing total female employment in SIC 335 to reach 12,755 in 1981.

The Product Fabricating, Assembling and Repairing occupations created by far the most new female jobs - 1,445 new female jobs - from 1971 to 1981. Female employment as a percent of total employment was also the highest - at 59.0 percent in 1981 - in the Product Fabricating, Assembling and Repairing groups compared to all the other broad occupational groups in 1981.

The Machining and Related, the Material Handling and Related and the Processing occupations all experienced declines in female employment from 1971 to 1981. Nonetheless female employment as a percent of total employment continued to be relatively high in these occupations - at 40.9 percent, 38.7 percent and 37.7 percent respectively.

At the more detailed occupational level, the electronic equipment fabricating and assembling occupations gained the most jobs for women - 1,545 - from 1971 to 1981. Nonetheless, female employment as a percent of total employment declined from 82.0 percent in 1971 to 78.3 percent in 1981. The electrical equipment fabricating and assembling occupations experienced the largest decline in female employment - a loss of 620 jobs - from 1971 to 1981. Female employment as a percent of total employment, however, continued to be 71.2 percent in 1981 in this category.

Female employment as a percent of total employment was highest - 81.1 percent in 1981 - in the welding and flame cutting occupations. However, this group only accounted for 450 jobs of a total of 12,755 positions held by women in 1981.

In absolute terms, the electronic equipment fabricating and assembling occupation offered the largest gains - 3,725 jobs or 29.2 percent of total female employment in SIC 335 in 1981. No females were employed in tool and die-making, or supervision in other occupations in architecture and engineering, as mechanical engineers or as general managers and other senior officials in 1981.

PART III - FUTURE TRENDS: THE SURVEY RESULTS

Part III of this study presents the survey results which discuss the firms' surveyed opinions as to future trends in technology adoption and employment impacts.

3.0 ADOPTION OF NEW TECHNOLOGY

This chapter reviews the expected trends in the adoption of new technologies in the Communications Equipment manufacturing industry and the factors driving the need for and affecting the rate of technology adoption.

3.1 New Technologies and Rates of Adoption

Much new technology has already been introduced into the manufacturing process. Firm size does not appear to be a significant constraint except for small firms, whose range of new technologies adopted appears to be significantly narrower than that of other firms.

Respondents indicate that they plan significant purchases in virtually all stages of production. Firms' acquisitions to date and future intentions are summarized in Table 2.

3.1.1 Product Technologies

The industry has begun to incorporate microprocessors into its products for many uses. About 47 percent of the industry is estimated to make use of these devices, which are important in modern telephone switchgear and related areas. Other new product technologies already in use include microwave integrated circuits and multi-layer printed circuits. The industry respondents provide no detail about upcoming developments in product technology.

Results of Question 3

TABLE 2: COMMUNICATIONS EQUIPMENT MANUFACTURERS

SIC 335

Percent of Firms Planning to Adopt New Technologies by Employment Size

Technologies	Before 1985				1985-1990				1990-1995			
	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
1. PRODUCT TECHNOLOGIES												
Products with Installed Microprocessors	50	33	80	47	-	-	-	-	-	-	-	-
Other	0	33	40	29	-	-	-	-	-	-	-	-
2. DESIGN TECHNOLOGIES												
Computer-Aided Design (CAD)	0	40	40	40	50	20	60	35	-	-	-	-
Computer-Aided Engineering (CAE)	0	80	60	74	-	-	20	6	-	-	-	-
CAD/CAM Integration	0	0	20	6	50	20	80	40	-	60	-	42
Other	0	0	20	6	-	-	-	-	-	-	-	-
3. MANUFACTURING PLANNING AND CONTROL TECHNOLOGIES												
Computerized Financial Systems	100	80	80	83	50	-	20	13	-	-	-	-
Computerized Order Entry/Inventory Control	100	75	80	81	50	25	20	28	-	-	-	-
Computer-Aided Process Planning	50	0	60	23	-	75	-	41	-	-	20	6
Manufacturing Resource Planning Systems (MRP)	0	20	40	22	-	60	20	41	-	20	-	12
Automated Shop Floor Data Collection	50	20	20	25	-	40	60	39	-	40	-	24
Computerized Decision Support Systems	0	50	20	33	-	25	20	19	50	-	20	13
Computerized Maintenance Planning and Control	0	0	60	15	50	60	40	54	-	20	-	12
Other	0	0	20	6	-	-	-	-	-	-	-	-
4. MANUFACTURING PROCESS TECHNOLOGIES												
Computerized Process Control Systems	50	40	60	46	-	20	40	22	-	-	-	-
Computer-Aided Inspection and Testing	100	40	100	64	-	80	-	48	-	-	-	-
Robotic Applications	0	0	60	15	-	80	20	53	50	20	20	25
Flexible Manufacturing Technologies	0	25	20	19	-	25	20	19	50	-	20	13
Computer Integrated Manufacturing (CIM)	0	0	20	6	-	25	40	25	50	50	20	43
Other	0	0	20	7	50	-	20	13	-	-	-	-
5. MATERIALS HANDLING TECHNOLOGIES												
Automated Conveyor/Vehicle Systems	0	0	40	11	-	50	20	33	-	-	-	-
Automated Storage and Retrieval	0	0	20	7	-	33	20	22	-	33	20	22
Computer Controlled Conveyor/Vehicles	0	0	20	7	-	33	40	29	-	-	-	-
Automated Warehouse	0	0	0	0	-	-	-	-	-	33	20	22
Other	0	0	20	7	-	-	-	-	-	-	-	-
6. TELECOMMUNICATIONS TECHNOLOGIES												
Facsimile (FAX) Link: HO/Plant(s)	50	80	100	80	-	-	-	-	-	-	-	-
Computer Link: HO/Plant(s)	0	100	80	77	-	-	-	-	-	-	-	-
Computer Link: Suppliers/Customers	0	25	20	19	50	25	40	33	-	-	-	-
Other	0	0	20	7	-	-	-	-	-	-	-	-
7. OTHER TECHNOLOGIES	0	0	0	0	-	-	20	7	-	-	-	-

(1) '0' used prior to 1985 to indicate have not adopted. '-' used for periods 1985-1990 and 1990-1995 to indicate respondents, at the time of the survey, are not planning to adopt this technology or 'don't know'. Responses are not mutally exclusive.

3.1.2 Design Technologies

Large and medium sized firms have computers in place to assist in design (CAD) and engineering (CAE) tasks. An estimated 40 percent of the industry is using CAD while about 74 percent is using CAE. However, integration between design and manufacture stands at just 6 percent. Large and small firms plan to make progress in integration in the 1985 to 1990 period while medium sized firms will integrate mostly in the 1990's.

3.1.3 Manufacturing Planning and Control Technologies

Planning and control tasks are benefiting from new technology adoption. Computers are being used by about 80 percent of the industry in financial systems and order entry/inventory control. Small firms are also using computers in these areas as well as in process planning, but have not followed medium and large sized firms into applications for decision support and maintenance planning and control. Industry penetration rates for areas outside financial systems and order entry run from 15 to 35 percent.

Although medium sized firms lag their larger counterparts at present in adopting new planning and control technologies, they plan to innovate in several areas, especially in the 1985 to 1990 period. For example, about 60 percent of respondents in these categories expect to introduce manufacturing resource planning systems and computerized maintenance planning and control before 1990.

3.1.4 Manufacturing Process Technologies

Large firms have taken the lead in introducing new technology in physical production. Inspection and testing is computer aided for 64 percent of the industry and process control systems are computerized for 46 percent. Other new technologies are less common. Again, medium sized firms plan to purchase heavily to catch up to large firms, who will continue to augment their stock of advanced machinery and techniques in the 1985-1990 period. About 48 percent of the industry will purchase some computer aided testing equipment in these years, for example. In three areas, robotics, flexible manufacturing and computer integrated manufacturing, large and medium sized firms envision a steady program of purchasing up to 1995.

3.1.5 Materials Handling Technologies

To date, technological change in materials handling is the sole province of large firms. Only 20 to 40 percent of these have adopted such systems as automated conveyors and storage and retrieval. Medium sized firms will join them in acquiring these systems, so that between 22 and 33 percent of the industry will make purchases in various areas in the five years to 1990. About 22 percent of the industry is expected to invest in automated warehousing along with storage and retrieval between 1990 and 1995.

3.1.6 Telecommunications Technologies

Firms have linked their head offices and plants by facsimile (FAX) and computer. About 80 percent of the industry makes use of these systems. Some progress has

been made in extending computer linkages to suppliers and customers but more is to be done in the 1985 to 1990 period. About 33 percent of the industry expects to invest in this computer link.

3.2 Forces Driving the Need to Adopt New Technology

The industry feels that competitive pressures are the primary impetus for incorporating new technology into its products and manufacturing processes. For medium sized firms, this pressure is expressed as well in the need to lower costs over time to match competitors' cost reductions. Secondary considerations for them are the need to increase productivity and to respond effectively to customers' demands for change.

Small firms see such customer demands for new or improved products as their primary spur to innovation, but consider growth trends and competitive pressure to be important as well. An important component of this competition is the low cost offshore production emanating from the Far East and other areas. Low wage costs for foreign producers relative to Canadian firms are forcing firms in Ontario to look to new technology for assistance in adjusting to downward price pressure.

The large firms selected competitive pressure as the most significant factor, inducing technological change. However, they also see a need to be prepared for new growth opportunities in fast growing markets. Other considerations cited include the need to preserve or improve profits and increase productivity. Respondents' views are recorded in Table 3.

3.3 Factors that Could Slow the Rate of Technology Adoption

Firms cite the effects of poor economic conditions as the most significant potential restraining factor on technological change.

Results of Question 4

TABLE 3: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Most Important Factors Driving the Need to Adopt New Technologies

Factor		Percent of Firms by Employment Size			
		Small (20-99)	Medium (100-499)	Large (500+)	Total Firms
COMPETITIVE PRESSURES	First	0	60	40	46
	Second	50	20	0	20
	Third	0	0	0	0
	Weighted Importance (1)	1.0	2.2	1.2	1.8
CUSTOMER DEMANDS FOR CHANGES	First	50	0	0	8
	Second	0	20	0	12
	Third	0	0	0	0
	Weighted Importance	1.5	0.4	0.0	0.5
INCREASE PROFITABILITY	First	0	0	0	0
	Second	0	0	20	5
	Third	100	0	20	12
	Weighted Importance	1.0	0.0	0.6	0.2
INCREASE PRODUCTIVITY	First	0	0	0	0
	Second	0	40	20	29
	Third	0	0	0	0
	Weighted Importance	0.0	0.8	0.4	0.6
INCREASE QUALITY	First	0	0	0	0
	Second	0	20	0	12
	Third	0	20	40	22
	Weighted Importance	0.0	0.6	0.4	0.5
INCREASE MANAGEMENT INFORMATION	First	0	0	0	0
	Second	0	0	0	0
	Third	0	20	0	12
	Weighted Importance	0.0	0.2	0.0	0.1
LOWER COSTS	First	0	40	0	24
	Second	0	0	0	0
	Third	0	0	0	0
	Weighted Importance	0.0	1.2	0.0	0.7
INCREASE SKILLS/ ORGANIZATIONAL CAPABILITY	First	0	0	0	0
	Second	50	0	20	12
	Third	0	20	0	12
	Weighted Importance	1.0	0.2	0.4	0.4
ENTER NEW MARKETS/ GROWTH	First	50	0	40	17
	Second	0	0	0	0
	Third	0	20	0	12
	Weighted Importance	1.5	0.2	1.2	0.6
OBSOLESCENCE	First	0	0	0	0
	Second	0	0	20	5
	Third	0	0	0	0
	Weighted Importance	0.0	0.0	0.4	0.1
ALL OTHERS	First	0	0	20	5
	Second	0	0	0	0
	Third	0	0	0	0
	Weighted Importance	0.0	0.0	0.6	0.2

(1) Weighted Importance = (First % x 3) + (Second % x 2) + (Third % x 1)

Results of Question 5

TABLE 4: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Most Important Factors that Could Slow the Rate of New Technology Adoption

Factor		Percent of Firms by Employment Size			
		Small (20-99)	Medium (100-499)	Large (500+)	Total Firms
ABILITY TO FINANCE	First	0	20	20	17
	Second	50	20	40	29
	Third	0	0	0	0
	Weighted Importance (1)	1.0	1.0	1.4	1.1
COST OF NEW TECHNOLOGY	First	0	0	0	0
	Second	0	40	0	24
	Third	0	0	0	0
	Weighted Importance	0.0	0.8	0.0	0.5
LACK OF GOVERNMENT ASSISTANCE	First	0	0	0	0
	Second	0	0	0	0
	Third	0	0	20	5
	Weighted Importance	0.0	0.0	0.2	0.1
COMPETITIVE ENVIRONMENT	First	0	0	20	5
	Second	0	20	0	12
	Third	0	0	0	0
	Weighted Importance	0.0	0.4	0.6	0.4
POOR ECONOMIC CONDITIONS	First	50	40	40	41
	Second	50	0	0	8
	Third	0	20	0	12
	Weighted Importance	2.0	1.4	1.2	1.5
UNION RESISTANCE	First	0	0	0	0
	Second	0	0	20	5
	Third	0	0	0	0
	Weighted Importance	0.0	0.0	0.4	0.1
LACK OF SKILLS AND/OR KNOW-HOW TO IMPLEMENT	First	0	20	0	12
	Second	0	0	20	5
	Third	0	20	20	17
	Weighted Importance	0.0	0.8	0.6	0.6
ALL OTHERS	First	50	20	20	25
	Second	0	0	20	5
	Third	100	20	0	19
	Weighted Importance	2.5	0.8	1.0	1.0

(1) Weighted Importance = (First % x 3) + (Second % x 2) + (Third % x 1)

Closely related to this factor is the ability to finance the acquisition of new technology, since a weak economy restricts profits and reduces available investment funds. Other possible restraining influences for these firms on the rate of technology adoption include the cost of acquiring equipment which incorporates new technology and the possible difficulty in building a work force with sufficient skills.

Small firms also express concern about poor economic conditions but stress as well the importance of foreign competition which threatens to make inroads on their market share. Table 4 records the respondents views.

Results of Question 1

TABLE 5: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Manufacturing Shipments in Ontario

(1)
Average Annual Compound Rate of Change (in Constant Dollars)

Firms by Employment Size	Estimated 1982-1983	Estimated 1983-1984	Estimated 1984-1985	Expected 1985-1990	Expected 1990-1995
Small (20-99)	6.0	4.0	5.0	7.5	7.5
Medium (100-499)	2.5	8.5	-6.5	10.5	10.0
Large (500+)	11.5	19.5	35.5	21.0	13.5
Total Firms	5.0	10.5	6.0	12.5	10.5

(1) Rounded to closest 0.5%

4.0 INDUSTRY OUTLOOK TO 1995

This chapter reviews the anticipated outlook for the industry in terms of aggregate output (i.e. constant dollar manufacturing shipments), investment plans, aggregate employment and changes in occupational structure to 1995.

4.1 Output to 1995

Communications Equipment shipments in constant dollars are expected to grow by about 6.0 percent in 1985. This growth is relatively slow when compared with expectations for 1985 to 1990 of about 12.5 percent per annum and for 1990 to 1995 of about 10.5 percent per annum. Table 5 records the survey results.

4.2 Investment Patterns

The industry expects to concentrate its investment expenditures in machinery and equipment in the years to 1995, spending about 83 percent in this area and only 17 percent on structures. New technology will play an important role in this investment, comprising about 33 percent of outlays on structures and about 50 percent of outlays on machinery and equipment.

4.2.1 Justifying Financial Investment in New Technology

As with other investment, new technology investment is subjected to formal tests of profitability. The industry appears to require a return on investment of about 22 percent to justify the application of funds. The use of an ROI criterion is widespread, being applied by an estimated 83 percent of the industry. A pay-back period criterion is used by 75 percent of the industry, with an average period of about 4 years to earn back an investment expenditure. Results by firm size are presented in Table 6.

Results of Question 17e

TABLE 6: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Justifying Financial Investment in New Technology

Firms by Employment Size	Pay-Back Period: % of Firms Using Pay-Back	Pay-Back Period: Average Period	Return on Investment: % of Firms Using ROI	Return on Investment: Average Rate
Small (20-99)	50	5	100	16.0
Medium (100-499)	80	3	80	23.0
Large (500+)	80	4	80	22.0
Total Firms	75	4	83	22.0

Answers are not mutually exclusive.

Results of Question 17f

TABLE 7: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Source of Funds for New Technology Spending

Firms by Employment Size	Internal Funds (Percent)	External Funds (Percent)
Small (20-99)	75	25
Medium (100-499)	88	12
Large (500+)	80	20
Total Firms	84	16

4.2.2 Sources of New Capital Spending

The industry expects to rely mainly on its own funds to finance the acquisition of plant and equipment with a new technology component. Dependence on internal funds varies somewhat with firm size, the industry average being 84 percent reliance on internal funds. See Table 7 for details.

4.3 Employment to 1995

This section reviews expected trends in employment patterns and outlines the most important factors affecting aggregate industry employment in Ontario.

4.3.1 Factors Affecting Employment

The most important influence on firm employment is believed to be industry-wide growth, followed closely by firms' sales levels. Another significant factor is the introduction of new technology. Large firms also lay stress on the ability to compete. See Table 8 for details of respondents' views.

4.3.2 Employment Outlook

The industry expects employment to contract by 6.5 percent in 1985 after an increase of 4.0 percent in 1984. This contraction is viewed as a pause before restrained growth is resumed in future. On average, firms see 3.0 percent growth per annum from 1985 to 1990 and 4.5 percent growth per annum from 1990 to 1995.

Opinions about employment prospects varied by firm size with small and medium sized firms anticipating large declines in 1985 but large increases in the coming decade to counter this decline. In contrast, the large firms see

Results of Question 11a,b,c

TABLE 8: COMMUNICATIONS EQUIPMENT MANUFACTURERS — SIC 335

Most Important Factors Affecting The Firms' Employment in Ontario

Factor		Percent of Firms by Employment Size: Small (20-99)	Medium (100-499)	Large (500+)	Total Firms
INCREASE SALES/ INCREASE MARKET SHARE	First	100	0	40	25
	Second	0	20	0	12
	Third (1)	0	0	0	0
	Weighted Importance	3.0	0.4	1.2	1.0
INTRODUCTION OF NEW TECHNOLOGY	First	0	20	0	12
	Second	0	20	40	22
	Third	0	40	0	24
	Weighted Importance	0.0	1.4	0.8	1.0
SUCCESS IN FOREIGN MARKETS	First	0	0	20	5
	Second	0	0	0	0
	Third	0	0	0	0
	Weighted Importance	0.0	0.0	0.6	0.2
PRODUCT DIVERSIFICATION	First	0	0	0	0
	Second	0	20	0	12
	Third	0	0	20	5
	Weighted Importance	0.0	0.4	0.2	0.3
AVAILABILITY OF NECESSARY SKILLS	First	0	0	0	0
	Second	0	0	20	5
	Third	0	0	0	0
	Weighted Importance	0.0	0.0	0.4	0.1
ABILITY TO COMPETE	First	0	0	20	5
	Second	50	20	20	25
	Third	0	0	0	0
	Weighted Importance	1.0	0.4	1.0	0.7
INDUSTRY-WIDE GROWTH	First	0	60	20	41
	Second	0	0	0	0
	Third	0	0	0	0
	Weighted Importance	0.0	1.8	0.6	1.2
OVERALL ECONOMIC GROWTH	First	0	20	0	12
	Second	0	20	0	12
	Third	0	0	0	0
	Weighted Importance	0.0	1.0	0.0	0.6

(1) Weighted Importance = (First % x 3) + (Second % x 2) + (Third % x 1)

Results of Question 11d

TABLE 9: COMMUNICATIONS EQUIPMENT MANUFACTURERS — SIC 335

Firms' Employment Trends in Ontario

Firms by Employment Size	Total Employment and Average Annual Compound Rate of Change (1)			
	Estimated Rate		Expected Rate	
	1981-1984	1984-1985	1985-1990	1990-1995
Small (20-99)	2.0	-35.0	10.5	9.0
Medium (100-499)	28.0	-16.5	11.5	12.0
Large (500+)	-0.5	-2.5	0.0	0.5
Total Firms	4.0	-6.5	3.0	4.5

(1) Rounded to closest 0.5%.

almost no growth in employment to 1995. These views are summarized in Table 9.

A comparison with industry average views on constant dollar shipment growth shows that firms expect relatively more rapid shipment growth than employment growth.

4.3.3 Trends in Part-Time Work

Part time employment is currently a small share of total employment, about 0.5 to 1.0 percent according to our survey estimates. Firms expect some increases in future, with the industry average rising to about 2.0 percent by 1990. Large firms anticipate that part-time employment will be 4.5 percent of their work force by 1995, while others expect to have no part-time help.

4.4 Changes in Occupational Structure

Table 10 shows trends in firms' occupational structure (i.e., percent of total industry employment by occupation) for the period 1981 to 1995. Major occupational group trends are as follows:

- Managerial employment's share will remain stable.
- Natural Sciences, Engineering and Mathematics will show a rapidly increasing share of total employment, increasing from 13.5 percent in 1984 to 19.6 percent in 1995.
- Processing's share will be stable and small.
- Machining's share will average around 3.0 percent.

- Fabricating, Assembling and Repairing will see a decline in its share of the total from a high of 57.9 percent in 1984 to an anticipated 52.3 percent in 1995.

- Materials Handling will increase its share during the 1985 anticipated decline in employment level, then decline slowly as employment levels rise in the 1985 to 1995 period.

- All Other Occupations will be a declining share of the total.

A review of the individual occupations shows which of these will be the focus of an occupational group's increase or decrease in share. Increases in Natural Sciences are expected to be concentrated in electrical engineering and engineering technician positions, with some share increase for systems analysts. Machine tool operators may be the occupation which yields much of the gentle decline in machining's share. In Fabricating jobs, the share decline of electrical equipment Fabricating is expected to be offset by small increases in electronic equipment fabricating and inspecting and testing positions.

Technological change may have the effect as well of blurring existing occupational lines since the nature of a task may change along with the technology in use. Thus, some declines or increases in occupational share may occur because certain tasks may be shifted from one job category to another, bringing associated employees with them, perhaps after retraining.

Results of Question 12

TABLE 10: COMMUNICATIONS EQUIPMENT MANUFACTURERS

SIC 335

Trends in Firms' Occupational Structure

Occupations	Percent of Total Employment by Selected Occupational Categories				
	Estimated			Expected	
	1981	1984	1985	1990	1995
MANAGERIAL, ADMINISTRATIVE AND RELATED	11.4	11.4	11.7	11.6	11.5
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS	13.4	13.5	15.8	17.2	19.6
• Electrical Engineers		-	+	+	o
• All Other Engineers		o	o	o	+
• Engineering Technicians and Technologists		+	o	+	+
• Systems Analysts and Computer Programmers		o	+	o	+
• All Other Science and Mathematics (not listed above)		o	o	-	-
PROCESSING	0.3	0.4	0.3	0.3	0.3
MACHINING	3.5	3.4	3.0	3.1	3.3
• Tool and Die Making		o	o	o	o
• Machinist and Machine Tool Setting-Up		o	o	+	-
• Machine-Tool Operators		-	o	-	o
• Welding/Soldering		o	o	o	o
• All Other Machining (not listed above)		o	o	o	o
FABRICATING, ASSEMBLING AND REPAIRING	55.2	57.9	55.4	54.0	52.3
• Foremen		-	o	o	+
• Electrical Equipment Fabricating and Assembling		o	-	-	-
• Electronic Equipment Fabricating and Assembling		+	-	o	+
• Inspecting and Testing Occupations: Electronic/ Electrical Equipment		-	o	+	o
• All Other Fabricating, Assembling and Repairing (not listed above)		o	o	o	o
MATERIALS HANDLING AND RELATED	5.1	5.0	5.8	5.6	5.5
ALL OTHER OCCUPATIONS	11.0	8.5	7.9	8.3	7.6
TOTAL	100%	100%	100%	100%	100%

+ increase - decrease o no change

5.0 EMPLOYMENT EFFECTS OF NEW TECHNOLOGY

This chapter reviews the survey results on the employment effects of new technology in terms of skills match and requirements and impact on skill levels and job content.

5.1 Effect in Occupations

Table 11 summarizes firms' views on how technology will affect their occupational requirements. The table indicates that respondents are divided about the impact of technological change on employment needs. A majority of the industry expects shortages to develop for managerial staff, systems analysts and fabricating foremen. Similarly, a majority of the industry sees an oversupply developing for electronic equipment fabricating and assembling, as well as inspecting and testing and materials handling occupations. In most cases views are divided or respondents are undecided.

5.2 Likely Steps to Deal with Oversupply

Layoffs and attrition are cited by respondents as being the most important techniques of reducing an oversupply of skills in most job categories. Layoffs are the primary step cited in most cases. Other methods of reducing oversupply listed include retraining and upgrading. Table 12 contains results of the survey on this question.

5.3 Likely Steps to Deal with Skills Shortages

Recruiting is the most important tool for dealing with possible future worker shortages, according to respondents. In occupations requiring a relatively high educational level upgrading is expected to play a significant secondary role in meeting employees' needs for a work force trained to apply new technology. For other occupations, such as those in machining, fabricating and materials handling, retraining is an important

Results of Question 6

TABLE 11: COMMUNICATIONS EQUIPMENT MANUFACTURERS — SIC 335

Impact of Technology on Selected Occupations in Firms 1985-1995

Occupations	Percent of Firms		
	Oversupply	Shortage	No Response
MANAGERIAL, ADMINISTRATIVE AND RELATED	13	56	32
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS			
• Electrical Engineers	27	27	46
• All Other Engineers	39	10	51
• Engineering Technicians and Technologists	39	44	17
• Systems Analysts and Computer Programmers	15	63	22
PROCESSING	13	5	82
MACHINING			
• Tool and Die Making	5	34	61
• Machinist and Machine Tool Setting-Up	17	22	61
• Machine-Tool Operators	29	5	66
• Welding/ Soldering	18	18	64
FABRICATING, ASSEMBLING AND REPAIRING			
• Foremen	24	61	15
• Electrical Equipment Fabricating and Assembling	27	15	58
• Electronic Equipment Fabricating and Assembling	58	25	17
• Inspecting and Testing Occupations: Electronic/ Electrical Equipment	55	39	6
MATERIALS HANDLING AND RELATED	56	5	39
OTHER	5	34	61

Results of Question 7

TABLE 12: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Steps Firms Will Likely Take to Deal With an OVERSUPPLY of Skills 1985-1995

Occupations	Most Commonly Cited	Second Most Common	Third Most Common
MANAGERIAL, ADMINISTRATIVE AND RELATED	Layoff	Attrition	(1)
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS			
• Electrical Engineers	Layoff	Attrition	(1)
• All Other Engineers	Layoff	Attrition	(1)
• Engineering Technicians and Technologists	Layoff	Attrition	(1)
• Systems Analysts and Computer Programmers	Layoff	(2)	(2)
PROCESSING	Layoff	Attrition	(1)
MACHINING			
• Tool and Die Making	Attrition	Retrain	(1)
• Machinist and Machine Tool Setting-Up	Attrition	Layoff	Retrain
• Machine-Tool Operators	Layoff/Transfer	Attrition	Retrain
• Welding/Soldering	Layoff	Attrition	Retrain
FABRICATING, ASSEMBLING AND REPAIRING			
• Foremen	Layoff	Attrition	(1)
• Electrical Equipment Fabricating and Assembling	Retrain	Attrition	Layoff
• Electronic Equipment Fabricating and Assembling	Layoff	Attrition	Upgrade
• Inspecting and Testing Occupations: Electronic/ Electrical Equipment	Layoff	Attrition	Retrain
MATERIALS HANDLING AND RELATED	Layoff	Attrition	Retrain
OTHER	Retrain	Attrition	(1)

(1) Only two steps mentioned.
(2) Only one step mentioned.

Results of Question 8

TABLE 13: COMMUNICATIONS EQUIPMENT MANUFACTURERS — SIC 335

Steps Firms Will Likely Take to Deal With a SHORTAGE of Skills
1985-1995

Occupations	Most Commonly Cited	Second Most Common	Third Most Common
MANAGERIAL, ADMINISTRATIVE AND RELATED	Recruit	Upgrade	Retrain
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS			
• Electrical Engineers	Recruit	Upgrade	Retrain/Overtime
• All Other Engineers	Recruit	Upgrade	Overtime
• Engineering Technicians and Technologists	Recruit	Upgrade	Retrain
• Systems Analysts and Computer Programmers	Recruit	Upgrade	Contract Out
PROCESSING	Recruit	Upgrade	(1)
MACHINING			
• Tool and Die Making	Recruit	Contract Out	Upgrade
• Machinist and Machine Tool Setting-Up	Upgrade	Recruit	Contract Out
• Machine-Tool Operators	Contract Out	Recruit	(1)
• Welding/Soldering	Recruit	Retrain	Contract Out
FABRICATING, ASSEMBLING AND REPAIRING			
• Foremen	Retrain	Recruit	Upgrade
• Electrical Equipment Fabricating and Assembling	Recruit	Retrain	(1)
• Electronic Equipment Fabricating and Assembling	Recruit	Retrain	Upgrade
• Inspecting and Testing Occupations: Electronic/ Electrical Equipment	Recruit	Retrain	(1)
MATERIALS HANDLING AND RELATED	Recruit	Retrain	(1)
OTHER	Recruit	Contract Out	Retrain

(1) Only two steps mentioned.

aid to recruiting. Other techniques which may be important for some occupations are contracting work out and upgrading.

Respondents' views are displayed in Table 13.

5.4 Technology Impact on Skill Levels and Job Content

Respondents were asked to judge the expected impact of new technology on selected occupations in terms of:

- skills required,
- time required to achieve proficiency, and
- knowledge of their firms' operations.

Survey results appear in Table 14.

Firms believe that skill requirements will increase under the influence of technological change in all occupations. Fifty percent or more of the industry believe this to be true for all Managerial, Natural Sciences, Processing, Fabricating and Materials Handling work. Opinion regarding machining occupations is mixed, but leans towards a skills increase being required.

Respondents' views on time requirements are more varied than their views on skills. In most cases views are mixed, with no change in learning time expected by many, while other respondents are fairly evenly divided. Time increases are expected by the majority in only Management and Materials Handling occupations. Time decreases offsetting possible skill requirement increases may occur in several Machining categories. Equipment fabricating, both electrical and electronic, and inspecting and testing are also likely candidates for time decreases to offset skill requirement increases.

Results of Question 9

TABLE 14: COMMUNICATIONS EQUIPMENT MANUFACTURERS SIC 335

Impact of Technology on Skill Levels and Job Content

Occupations	Skills Required (1) Percent of Firms			Time to Achieve Proficiency (1) Percent of Firms			Knowledge of Firm's Operations (1) Percent of Firms		
	+	-	0	+	-	0	+	-	0
MANAGERIAL, ADMINISTRATIVE AND RELATED	87	0	13	52	10	38	75	0	25
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS									
• Electrical Engineers	50	0	50	14	33	53	41	12	47
• All Other Engineers	64	0	36	22	28	50	33	0	67
• Engineering Technicians and Technologists	87	0	13	38	16	46	41	0	59
• Systems Analysts and Computer Programmers	75	0	25	30	40	30	71	0	29
PROCESSING	62	0	38	38	35	27	38	0	62
MACHINING									
• Tool and Die Making	28	16	56	7	54	39	16	0	84
• Machinist and Machine Tool Setting-Up	57	15	28	37	35	28	15	0	85
• Machine-Tool Operators	48	30	22	22	56	22	15	0	85
• Welding/ Soldering	44	33	23	23	54	23	23	0	77
FABRICATING, ASSEMBLING AND REPAIRING									
• Foremen	82	0	18	30	22	48	53	0	47
• Electrical Equipment Fabricating and Assembling	60	0	40	12	48	40	23	0	77
• Electronic Equipment Fabricating and Assembling	51	14	35	20	39	41	26	0	74
• Inspecting and Testing Occupations: Electronic/ Electric Equipment	64	25	11	25	52	23	53	0	47
MATERIALS HANDLING AND RELATED	74	0	26	58	30	12	55	6	39
OTHER	100	0	0	0	41	59	59	0	41

\+ increase - decrease 0 remain the same

(1) Non-responses excluded.

The effect of new technology on knowledge requirements with respect to the firm's operations is expected to increase for all occupations. This belief is held by a large majority for Managerial, some Fabricating positions and Materials Handling. For Machining occupations, the majority expects no change.

5.5 Training Costs and New Technology

Training costs are a small proportion of total labour costs, estimated to be about 2.5 percent in 1984. They are expected to increase to about 4.0 percent by 1990 and continue at that level through to 1995.

New technology is expected to account for 30 to 40 percent of training costs in the years to 1995. Medium sized firms will experience a rise in this percentage while large firms may see their percentage decline. This corresponds to respondents' views on the rate of introduction of new technology. Medium sized firms appear to be planning relatively heavier purchases in the 1985-1995 period than large firms to compensate for the higher penetration rates of new technology among large firms up to 1985.

TABLE 15

INDUSTRIAL RELATIONS: COMMUNICATIONS EQUIPMENT INDUSTRY

UNION	NUMBER OF MEMBERS	MAJOR EMPLOYER*	LOCATION	TECHNOLOGICAL CHANGE CLAUSES
UNITED ELECTRICAL WORKERS	5,849	Canadian General Electric Co. Ltd.	Intercity	Training, Consultation, Income Protection, Transfer Arrangements
UNITED AUTO WORKERS	2,920	Northern Telecom Limited (Works)	Intercity	Advance Notice, Consultation, Training, Income Protection, Transfer Arrangements
	1,170		Intercity	Training
	680	Leigh Instruments Limited	Waterloo	Training
COMMUNICATIONS AND ELECTRONICS	748	Canadian General Electric Co. Ltd.	Intercity	Advance Notice, Consultation, Training, Transfer Arrangements
	712	Ael Microtel Limited	Brockville	None
	386	Northern Telecom Limited (Repair Overhaul Division)	Toronto	Advance Notice, Consultation, Training, Severance Pay, Income Protection, Transfer Arrangements
	375	(Installation)	Intercity	Consultation, Training
INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS	330	Rockwell International of Canada Ltd. (Collins Canada Division)	Toronto	None
INDEPENDENT LOCAL	501	Hammond Manufacturing	Guelph Puslinch	None
RUBBER WORKERS	370	J.E. Thomas Specialties	Lindsay	None
UNITED STEELWORKERS	207	Edwards (A Unit of General Signal)	Owen Sound	None

* Employer with a union agreement covering 200 employees or more.
The union agreements above represent 92 percent of unionized employees.

SOURCE: Collective Bargaining Agreement Systems, Ontario Ministry of Labour.

6.0 LABOUR RELATIONS ENVIRONMENT

This chapter discusses the labour relations environment in the industry.

6.1 Industrial Relations Environment: Historical

There are 15,544 unionized employees or 55 percent of the total 28,090 employees in the Communications Equipment industry. The major unions are the United Electrical Workers representing 40 percent of the unionized workers, the United Auto Workers representing 33 percent and Communications and Electronics, representing 15 percent. Other unions in the industry ranked in declining order of number of employees are:

- Independent Locals
- Rubber Workers
- Molders
- International Brotherhood of Electrical Workers
- United Steelworkers
- Canadian Communications Workers
- Engineer Associations
- Service Employees International

As indicated in Table 15, there are three large union agreements, one with Canadian General Electric covering 5,849 employees and two with Northern Telecom covering 3,306 employees.

6.2 Trends in Unionization

The survey indicates that an estimated 27 percent of the industry work force belongs to firms with some degree of unionization.

The percentage of firms unionized increases with firm size. Of unionized firms surveyed, it is estimated that about 66 percent of employees belong to a union. This percentage is expected to decline only very modestly to 1995. The survey's percentage does not include medium sized firm unionization rates because of incomplete data regarding anticipated total employment. This may produce a slightly lower industry average for total firms.

6.3 Technology Change Clauses

Technology change clauses are found, according to the survey, in large firms only. This is confirmed by Ontario Ministry of Labour information, the apparent exceptions being divisions of Northern Telecom, a large firm.

Of the large firms surveyed, 60 percent reported contracts with technology change clauses. Respondents say that 75 percent of these contracts have a clause requiring notice of technological change and 25 percent have clauses providing for both consultation and consideration for seniority in staff changes. Survey responses are presented in Table 16.

Ministry of Labour information supplements this picture. There are clauses which also provide for:

- income protection for displaced workers who assume another lower paying position,
- transfer arrangements for displaced employees so that they may work elsewhere within the company,
- training of employees affected by technological change, to qualify for other jobs, and
- severance pay for those employees displaced by new technology.

Results of Question 15d,e

TABLE 16: COMMUNICATIONS EQUIPMENT MANUFACTURERS

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Unions and Technology Change

Firms by Employment Size	Percent of Contracts with a Technology Change Clause	Percent of Technology Change Clauses Covering					
		Notice/ Disclosure	Consultation/ Participation	Joint Committee	Job Security	Seniority	Other
Small (20-99)	n.a.						
Medium (100-499)	0	-	-	-	-	-	-
Large (500+)	60	75	25	0	0	25	0
Total Firms	50	60	20	0	0	20	0

6.4 Management's Perception of their Union's Position on New Technology

Firm executives believe that most unions do not readily accept new technology. Leading concerns of unions, they believe, are to ensure job security for their members and to limit the effect of technological change on union membership. Firms also believe that unions are concerned that their members get the training that will make them eligible to use the new technology.

Union respondents partially confirm company executives attitudes in their questionnaires. They show an interest in job security and other tenure issues such as seniority-based relocation opportunities. However, they also appreciate the role of technology in generating business and, by implication, employment. This point of view differs somewhat from the firm perspective of union unwillingness to accept technological change.

6.5 Nature of Worker Involvement in the Process of Technological Change

Firms were asked whether they had a formal mechanism for worker participation in setting production and/or sales targets, improving productivity and/or quality and adopting new technology.

Formal mechanisms for setting production or sales targets exist to a limited extent in the industry. Between 17 and 23 percent of the industry at each level of organization has such mechanisms. They appear to enjoy wider acceptance among larger firms than smaller with 60 percent of large firms having formal mechanisms at the working group level.

Acceptance of a formal role for workers in improving productivity and/or product quality increases with firm size, with all large firms engaged in this activity and about 56 percent of the industry as a whole doing so. In contrast, formal participation in decisions on adopting new technology is only very narrowly accepted, by just 5 percent of the industry, and only among large firms.

6.6 Views on Involving Workers in Decisions on Adopting New Technology

Management and union leaders were asked to what extent management should involve workers in decisions regarding the adoption of new technology.

Many managers feel that the decision on whether to adopt an innovation should be exclusively a management decision. About 57 percent of the industry believes that workers have no role to play in this process. The larger the firm, on average, the less prevalent is this attitude.

Managers who disagree with this position outline several steps that they believe are worthwhile. These include prior consultation on technology adoption, explanation of the need to introduce new machinery and techniques and of the effect of these changes on job tenure. Most importantly, they stress the need to engage in discussion with workers during the implementation phase. Some executives of large firms express an interest in formalizing involvement through the setting up of training programs.

Union respondents reject the notion that workers should not be involved in the decision to acquire new technology. Discussion is essential, they say, because jobs are interdependent and new technology for one area may have side effects for other workers. Another prominent concern is that training programs be instituted to give established workers a chance to qualify for work with new equipment. Their general view is that unions' and workers' roles in influencing technological change at this point are minimal.

7.0 PLANNING FOR TECHNOLOGICAL CHANGE

This chapter reports survey results regarding questions related to planning for technological change. A summary of these results appears in Table 17.

The survey indicates that the degree of planning for new technology introduction depends on firm size. Respondents from small firms record significant use of all forms of planning, while all large firms have strategic and human resource plans as well as capital investment plans for new technology. Medium sized firms make widespread use of strategic planning, but only 20 percent have a human resources plan to help them anticipate the needs produced by introducing new technology. As well, the table shows that those firms in the medium size group with capital investment plans have relatively short planning horizons when compared with other firms surveyed.

Firms were asked to rate the degree of integration between their resource and capital plans on a scale of 1 - "not at all integrated", to 5 "highly integrated". Integration of plans is not significantly higher for large firms than it is for medium sized firms despite the universal adoption of these types of planning by large firms. Small firms report a somewhat higher level of integration than do others. The degree to which the planning process has been formalized to date does not appear to have influenced the extent to which the different planning tasks are jointly considered.

Results of Question 18

TABLE 17: COMMUNICATIONS EQUIPMENT MANUFACTURERS

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Planning for Technological Change

Firms by Employment Size	Strategic Plan: Percent of Firms With Plan	Human Resource Plan: Percent of Firms With Plan	Human Resource Plan: Length of Planning Horizon	Capital Investment Plan: Percent of Firms With Plan	Capital Investment Plan: Length of Planning Horizon	Perceived Integration Between Capital and Human Plans (1)
Small (20-99)	50	50	5 years	50	5 years	4.0
Medium (100-499)	60	20	5 years	40	2 years	3.0
Large (500+)	100	100	5 years	100	5 years	3.4
Total Firms	61	37	5 years	49	4 years	3.2

1. Using a scale of 1 to 5; 1 represents "Not at all integrated" and 5 "Highly integrated".

PART IV - APPENDICES

Part IV of this report presents the appendices referred to in Parts I and II.

These appendices are:

Appendix	Title	Reference
A	Firm Employment Size Categories Used in the Survey of the Communications Equipment Industry	Part I
B	Questionnaire and Responses by Question	Part I Part III
C	Reliability of the Sample	Part I
D	Historical Tables	Part II

APPENDIX A

FIRM EMPLOYMENT SIZE CATEGORIES USED IN THE SURVEY OF THE COMMUNICATIONS EQUIPMENT INDUSTRY

FIRM EMPLOYMENT SIZE CATEGORIES USED IN THE SURVEY OF THE COMMUNICATIONS EQUIPMENT INDUSTRY

Size Categories Used to Stratify the Sample Frame		Size Categories Used to Weight and Report Survey Results	
Number of Employees			Number of Employees
20 - 49		Small	20 - 99
50 - 99			
100 - 199		Medium	100 - 499
200 - 499			
500 - 999		Large	500 or more
1000 - 1499			
1500 - 2499			
2500 - 4999			
5000 or more			

APPENDIX B

QUESTIONNAIRE

AND

RESPONSES BY QUESTION

ONTARIO TASK FORCE ON EMPLOYMENT AND NEW TECHNOLOGY

COMMUNICATIONS EQUIPMENT
(SIC 335)
QUESTIONNAIRE

Currie, Coopers & Lybrand
Management Consultants

INTRODUCTION

Thank you for agreeing to participate in the study. It is being carried out for the Ontario Task Force on Employment and New Technology, a joint labour-management group. Their mandate is to examine the extent and nature of employment change likely to result from the introduction and application of new technology in Ontario over the next ten years.

You Will Receive The Survey Results
As a participant, you will receive a report on the survey results for your industry.

All Responses Will Be Confidential
All responses will be held in strictest confidence. Responses will be analysed and used only at an industry-wide level.

Both Organized Labour and Management Are Being Surveyed
Management and organized labour participants, in the case of unionized firms, will both receive a questionnaire. We realize that labour participants may not be able to answer some of the questions. In particular, they may find difficulty in answering questions: 10, 11, 12, 13 and 17.

Participants May Want to Consult Key Resource People in Responding
The questionnaire is not necessarily meant to be completed by only one respondent. It may be appropriate and even desirable for survey participants to consult other key resource people in their firm before responding to the questionnaire. Respondents should indicate on the Participant Information (p.4), the "principle respondent" and "other respondents" as well as the Section(s) of the questionnaire to which they contributed.

You Will Save Time if Information is Filled in Before the Interview
A number of questions relate to your firm's past or present workforce and future plans. We are requesting management respondents to provide accurate information from their organization's records in advance of the interview. This step will reduce the time needed for the actual interview and also make it more meaningful. The Participant Information (p.4) and the following questions should be filled in prior to the management interview: 3, 6 to 13 inclusive, 15 and 17.

Group Interviews Are Possible
In some cases the principle respondent may want to arrange a group interview between himself, key resource people and our consultant. We would welcome such an arrangement. This option is open to either management or labour participants.

You May Wish to Complete the Entire Questionnaire Before the Interview
The entire questionnaire could be completed in advance of the interview. If this is convenient, please do so. We would, however, still wish to spend a half-hour with you to review your responses.

Your "Best" Estimate
Where estimates are required, we are asking respondents to provide us with their "best estimate". Estimating future trends is difficult. Our premise is that an expert inside the organization is in the best position to make them, based on his or her knowledge of the firm's future direction.

EXHIBIT A

SELECTED OCCUPATIONS: COMMUNICATIONS EQUIPMENT, SIC 335

MANAGERIAL, ADMINISTRATIVE & RELATED (includes senior and middle management and administrative support functions such as personnel officers, financial officers).

NATURAL SCIENCE, ENGINEERING & MATHEMATICS

Electrical Engineers.
All Other Engineers.
Engineering Technicians & Technologists.
Systems Analysts & Computer Programmers.

PROCESSING (includes materials processing occupations such as in metal processing: refining, smelting, heat treating, rolling, moulding, casting, extruding, plating, testing and inspecting).

MACHINING

Tool & Die Making.
Machinist & Machine Tool Setting-Up.
Machine Tool Operators.
Welding/Soldering.

FABRICATING, ASSEMBLING & REPAIRING

Foremen.
Electrical Equipment Fabricating & Assembling.
Electronic Equipment Fabricating & Assembling.
Inspecting & Testing Occupations: Electronic/Electrical Equipment.

MATERIAL HANDLING & RELATED (includes such occupations as hoisting, material handling equipment operators and packaging).

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The Study is Focusing on Selected Occupations

The Task Force for your industry is focusing on chosen major occupational groups and selected occupations within these major groups. These are listed in Exhibit A. The job titles and definitions being used are from the "Canadian Classification and Dictionary of Occupations, 1971" (CCDO). The CCDO is a universal system of job titles and descriptions. Our consultants are available to assist you or your staff in clarifying which of your firm's positions should be considered in the CCDO titles listed in Exhibit A.

Please Call If You Have Any Enquiries

Should you or your staff require any assistance, please call Sandra Skivsky of our firm or the consultant who will be interviewing you, at 366-1921.

Your Participation Is Appreciated

While we appreciate that your participation in the survey puts a demand on your time and organization, we would emphasize that your contribution will have an important impact on the results of this project.

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PARTICIPANT INFORMATION

COMPANY NAME: _____

UNION NAME (If appropriate): _____

AFFILIATED ORGANIZATIONS: _____

MAIN ADDRESS: _____

TELEPHONE NUMBER: (___) _____

BRIEF DESCRIPTION OF OPERATION IN ONTARIO

Divisions/Branches/Affiliates	Products/Services
_____	_____
_____	_____
_____	_____
_____	_____

SURVEY PARTICIPANTS

Names	Position	Number of Years With Company	Number of Years With Industry	Check (✓) Sections Answered II	III	IV	V	VI	VII
_____	_____	_____	_____	☐	☐	☐	☐	☐	☐
(principal respondent)									
_____	_____	_____	_____	☐	☐	☐	☐	☐	☐
(other respondents)									
_____	_____	_____	_____	☐	☐	☐	☐	☐	☐
_____	_____	_____	_____	☐	☐	☐	☐	☐	☐
_____	_____	_____	_____	☐	☐	☐	☐	☐	☐

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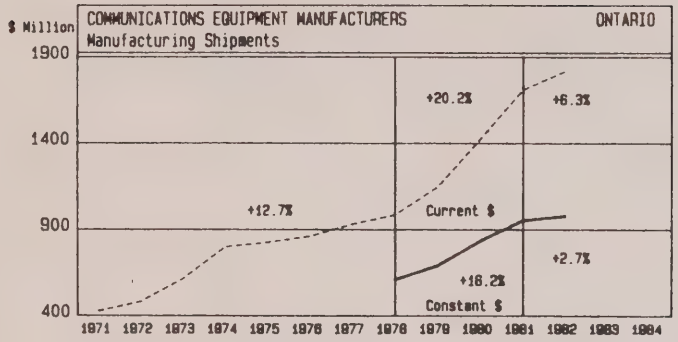
CHART 1

INDUSTRY-WIDE MANUFACTURING SHIPMENTS IN ONTARIO*



* Source: Statistics Canada, Manufacturing Industries of Canada: National and Provincial Areas, Cat. No. 31-203. Graph, constant dollar calculation and rates of change by Economics Practice, Currie, Coopers & Lybrand.

(SIC 335)

1. INDUSTRY-WIDE MANUFACTURING SHIPMENTS IN ONTARIO

Chart 1, opposite, illustrates manufacturing shipments for the Communications Equipment Industry in ONTARIO in current dollars (dotted line) and in constant dollars (current dollars adjusted for price changes, solid line).

The rate shown for the 1978 to 1982 time period below are expressed in annual compound rates of change (in constant dollars).

Using these as a guide, please **estimate** the annual compound rates of change (in constant dollars) of your industry's manufacturing shipments in Ontario for the next five periods listed.

Manufacturing Shipments in Ontario	Annual Compound Rate of Change (in constant dollars)
1971 to 1978	not available
1978 to 1981	+16.2%
1981 to 1982	+2.7 %
	Your Estimates (Indicate if + or -)
1982 to 1983?	___ %
1983 to 1984?	___ %
1984 to 1985?	___ %
1985 to 1990?	___ %
1991 to 1995?	___ %

(SIC 335)

2. INDUSTRY-WIDE OUTLOOK - EMPLOYMENT IN ONTARIO

The table below indicates total employment and annual compound rates of change for employment in the Communications Equipment Industry in ONTARIO between 1971 and 1982. (Statistics Canada, Cat. No. 31-203).

Would you please indicate your estimates for the five following periods listed below (i.e., 1983-1995). Provide your estimates in actual numbers or in annual compound rates of change, **whichever is easier.**

For your information, total employment covers full-time, part-time, temporary, casual and contract - i.e., total "head count".

Total Employment in Ontario		Annual Compound Rates of Change	
1971	23,057		
1981	28,059	1971-1981	+2.0 %
1982	28,090	1981-1982	-0.1 %

Your Estimates:

				(Indicate if + or -)
1983?	_____	OR	1982-1983?	____ %
1984?	_____	OR	1983-1984?	____ %
1985?	_____	OR	1984-1985?	____ %
1990?	_____	OR	1985-1990?	____ %
1995?	_____	OR	1990-1995?	____ %

(SIC 335)

3. FIRM'S ADOPTION OF TECHNOLOGIES

The following questions refer to new technologies your firm has already or may adopt over the next ten years in ONTARIO.

3a. Please indicate the technologies that have already been adopted by your firm. Record your answer on Chart 3, opposite, under column 3a.

3b. Please indicate the technologies that will probably be adopted by your firm between **1985 and 1990.** Record your answer on Chart 3, under column 3b. It may be appropriate to check more than one time period.

3c. Please indicate the technologies that will probably be adopted by your firm between **1991 and 1995.** Record your answer on Chart 3, under column 3c. It may be appropriate to check more than one time period.

(SIC 335)

CHART 3

TECHNOLOGIES ADOPTED OR TO BE ADOPTED BY THE FIRM

	3a ADOPTED IN 1984 OR BEFORE	3b WILL BE ADOPTED BETWEEN 1985-1990?	3c WILL BE ADOPTED BETWEEN 1991-1995?
1. PRODUCT TECHNOLOGIES			
Products With Installed Microprocessors	☐	☐	☐
Any Others? _____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
_____	☐	☐	☐
2. DESIGN TECHNOLOGIES			
Computer-Aided Design (CAD)	☐	☐	☐
Computer-Aided Engineering (CAE)	☐	☐	☐
CAD/CAM Integration	☐	☐	☐
Any Others? _____	☐	☐	☐
_____	☐	☐	☐
3. MANUFACTURING PLANNING & CONTROL SYSTEMS			
Computerized Financial Systems	☐	☐	☐
Computerized Order Entry/Inventory Control	☐	☐	☐
Computer-Aided Process Planning	☐	☐	☐
Manufacturing Resource Planning Systems (MRP)	☐	☐	☐
Automated Shop Floor Data Collection	☐	☐	☐
Computerized Decision Support Systems	☐	☐	☐
Computerized Maintenance Planning & Control	☐	☐	☐
Any Others? _____	☐	☐	☐
_____	☐	☐	☐
4. MANUFACTURING PROCESS TECHNOLOGIES			
Computerized Process Control Systems	☐	☐	☐
Computer-Aided Inspection & Testing	☐	☐	☐
Robotic Applications	☐	☐	☐
Flexible Manufacturing Technologies	☐	☐	☐
Computer Integrated Manufacturing (CIM)	☐	☐	☐
Any Others? _____	☐	☐	☐
_____	☐	☐	☐
5. MATERIALS HANDLING TECHNOLOGIES			
Automated Conveyor/Vehicle Systems	☐	☐	☐
Automated Storage & Retrieval	☐	☐	☐
Computer Controlled Conveyor/Vehicles	☐	☐	☐
Automated Warehouse	☐	☐	☐
Any Others? _____	☐	☐	☐
_____			
6. TELECOMMUNICATIONS TECHNOLOGIES			
Facsimile (FAX) Link: HO/Plants	☐	☐	☐
Computer Link: HO/Plant(s)	☐	☐	☐
Computer Link: Suppliers/Customers	☐	☐	☐
Any Others? _____	☐	☐	☐
_____			
7. OTHER TECHNOLOGIES			
_____	☐	☐	☐
_____			
HAVE/WILL NOT ADOPT ANY NEW TECHNOLOGIES IN THIS PERIOD	☐	☐	☐

(SIC 335)

4. FORCES DRIVING THE FIRM'S NEED FOR NEW TECHNOLOGIES OVER THE NEXT 10 YEARS

4a. What is the **single most important driving factor** in your firm's internal or external environment which could accelerate your **firm's need to adopt** these new technologies over the next 10 years in ONTARIO?

_____
_____
_____

4b. What is the **second most important factor** likely to accelerate your firm's need to adopt these new technologies?

_____
_____
_____

4c. And what is the **third most important factor**?

_____
_____
_____

5. FACTORS AFFECTING THE FIRM'S RATE OF TECHNOLOGY ADOPTION OVER THE NEXT 10 YEARS

5a. What is the **single most important factor** in your firm's internal or external environment that could <u>slow down</u> the speed at which your firm will adopt these new technologies over the next 10 years in ONTARIO?

_____
_____
_____

5b. What is the **second most important** factor that could slow down your firm's adoption of these new technologies?

_____
_____
_____

5c. And what is the **third** most important factor?

_____
_____
_____

6. IMPACT OF TECHNOLOGY ON OCCUPATIONS OVER THE NEXT 10 YEARS

The following questions attempt to determine impacts on specific occupations you expect to be caused by the adoption of new technologies in your firm over the next 10 years in ONTARIO.

6a. Please indicate the **occupations** in which your firm is likely to have an **oversupply of people** over the next 10 years as a result of the adoption of these new technologies. Record your answer on Chart 6, opposite, under column 6A.

6b. Please indicate the **occupations** in which you expect your firm will have **a shortage of the skills** required to cope with these new technologies. Record your answer on Chart 6, under column 6B.

(SIC 335)

CHART 6

IMPACT OF TECHNOLOGIES ON SELECTED OCCUPATIONS IN YOUR FIRM OVER THE NEXT 10 YEARS

	6a OCCUPATIONS WITH AN OVERSUPPLY OF SKILLS	6b OCCUPATIONS WITH A SHORTAGE OF THE REQUIRED SKILLS
MANAGERIAL, ADMINISTRATIVE & RELATED	☐	☐
NATURAL SCIENCE, ENGINEERING & MATHEMATICS		
• Electrical Engineers	☐	☐
• All Other Engineers	☐	☐
• Engineering Technicians & Technologists	☐	☐
• Systems Analysts & Computer Programmers	☐	☐
PROCESSING	☐	☐
MACHINING		
• Tool & Die Making	☐	☐
• Machinist & Machine Tool Setting-Up	☐	☐
• Machine Tool Operators	☐	☐
• Welding/Soldering	☐	☐
FABRICATING, ASSEMBLING & REPAIRING		
• Foremen	☐	☐
• Electrical Equipment Fabricating & Assembling	☐	☐
• Electronic Equipment Fabricating & Assembling	☐	☐
• Inspecting & Testing Occupations: Electronic/Electrical Equipment	☐	☐
MATERIAL HANDLING AND RELATED	☐	☐
ANY OTHER OCCUPATIONS SIGNIFICANTLY AFFECTED? WHICH ONES?		
_____	☐	☐
_____	☐	☐
_____	☐	☐

(SIC 335)

7. ACTIONS TO DEAL WITH OVERSUPPLY OF SKILLS IN FIRM OVER NEXT 10 YEARS

The following questions relate to the actions your firm will likely take to deal with the oversupply of people in your firm resulting from the adoption of these new technologies in ONTARIO.

7a. For each occupation with a potential oversupply of skills (as you indicated in Q.6a), please identify the **steps** your firm will likely take that will **affect the largest number of people** in that occupation. Record your answers on Chart 7, opposite, under column 7a.

In answering this and the following question, please consider the possible actions listed below as well as any other possible action not in the list but that your firm is likely to take.

Possible Actions

- Attrition
- Early Retirement
- Layoffs
- Relocation (geographic)
- Shorter hours/work week
- Job sharing
- Change from full-time to part-time
- Retraining
- Lateral transfer
- Upgrading
- Downgrading
- Etc. etc.,

7b. Again, for each of these occupations, identify the step your firm may take that will affect the **second largest number of people** in that occupation. Record on Chart 7, under column 7b.

(SIC 335)

CHART 7

STEPS FIRM WILL LIKELY TAKE
TO DEAL WITH OVERSUPPLY OF SKILLS OVER NEXT 10 YEARS

OCCUPATIONS	7a STEPS THAT WILL AFFECT THE LARGEST NUMBER OF PEOPLE IN THIS OCCUPATION	7b STEPS THAT WILL AFFECT THE 2ND LARGEST NUMBER OF PEOPLE IN THIS OCCUPATION
MANAGERIAL, ADMINISTRATIVE & RELATED		
NATURAL SCIENCE, ENGINEERING & MATHEMATICS		
• Electrical Engineers		
• All Other Engineers		
• Engineering Technicians & Technologists		
• Systems Analysts & Computer Programmers		
PROCESSING		
MACHINING		
• Tool & Die Making		
• Machinist & Machine Tool Setting-Up		
• Machine Tool Operators		
• Welding/Soldering		
FABRICATING & ASSEMBLING		
• Foremen		
• Electrical Equipment Fabricating & Assembling		
• Electronic Equipment Fabricating & Assembling		
• Inspecting & Testing Occupations: Electronic/Electrical Equipment		
MATERIAL HANDLING AND RELATED		
ANY OTHER OCCUPATIONS SIGNIFICANTLY AFFECTED? WHICH ONES?		
_____		
_____		
_____		

8. STEPS TO ACQUIRE THE NEW SKILL REQUIREMENTS OVER THE NEXT 10 YEARS

The following questions are intended to identify the most likely steps your firm may take to acquire the new skill requirements associated with the new technologies over the next 10 years in ONTARIO.

8a. Please indicate, for each occupation with a potential shortage of the new skill requirements (as you indicated in Q6b), the **step** your firm will likely take that will **affect the largest number of people** in that occupation. Record your answers on Chart 8, column 8a.

Please consider the possible actions listed below as well as any other action (not listed) that your firm is likely to take.

Likely Steps

- Retraining
- Relocation
- Upgrading
- Increased overtime of firm's skilled people
- Recruiting full-time skilled people
- Recruiting part-time skilled people
- Contracting work out
- Etc., etc...

8b. Please indicate, for each occupation, the **step** your firm may take that will affect the **second largest number of people** in that occupation. Record your answers in column 8b.

(SIC 335)

CHART 8

STEPS FIRM WILL TAKE
OVER NEXT 10 YEARS TO ACQUIRE THE NEW SKILL REQUIREMENTS

OCCUPATIONS	8a STEP WHICH WILL AFFECT THE LARGEST NUMBER OF PEOPLE IN THIS OCCUPATION	8b STEP WHICH WILL AFFECT THE 2ND LARGEST NUMBER OF PEOPLE IN THIS OCCUPATION
MANAGERIAL, ADMINISTRATIVE & RELATED		
NATURAL SCIENCE, ENGINEERING & MATHEMATICS		
• Electrical Engineers		
• All Other Engineers		
• Engineering Technicians & Technologists		
• Systems Analysts & Computer Programmers		
PROCESSING		
MACHINING		
• Tool & Die Making		
• Machinist & Machine Tool Setting-Up		
• Machine Tool Operators		
• Welding/Soldering		
FABRICATING & ASSEMBLING		
• Foremen		
• Electrical Equipment Fabricating & Assembling		
• Electronic Equipment Fabricating & Assembling		
• Inspecting & Testing Occupations: Electronic/Electrical Equipment		
MATERIAL HANDLING AND RELATED		
ANY OTHER OCCUPATIONS SIGNIFICANTLY AFFECTED? WHICH ONES?		
_____		
_____		
_____		

(SIC 335)

9. NATURE OF IMPACT ON SKILLS AND JOB CONTENT OVER THE NEXT TEN YEARS

The following questions are meant to identify the nature of the impact on selected occupations in ONTARIO.

9a. For selected occupations in your firm, please indicate how the new technologies will affect each in their daily work. That is; will their daily work require greater skill (+), less skill (-), or about the same skill (0) as they currently require. Record your answers on Chart 9, opposite, under Column 9a.

9b. Please indicate whether the new skills they require will demand more time (+), less time (-), or about the same time (0) to achieve the proficiency that they will need. Record your answers on Chart 9, column 9b.

9c. Please indicate whether, in using these new technologies, these occupations will require more knowledge (+) of the company's operations, less knowledge (-), or about the same (0) amount of knowledge as is currently required to perform their daily tasks. Record your answers on Chart 9, under 9c.

(SIC 335)

CHART 9

IMPACT OF TECHNOLOGY ON SKILL LEVELS AND JOB CONTENT

	9a SKILLS REQUIRED (+, -, 0)	9b TIME TO ACHIEVE PROFICIENCY (+, -, 0)	9c KNOWLEDGE OF COMPANY'S OPERATIONS (+, -, 0)	COMMENTS
MANAGERIAL, ADMINISTRATIVE & RELATED	___	___	___	_____
NATURAL SCIENCE, ENGINEERING & MATHEMATICS				
• Electrical Engineers	___	___	___	_____
• All Other Engineers	___	___	___	_____
• Engineering Technicians & Technologists	___	___	___	_____
• Systems Analysts & Computer Programmers	___	___	___	_____
PROCESSING	___	___	___	_____
MACHINING				
• Tool & Die Making	___	___	___	_____
• Machinist & Machine Tool Setting-Up	___	___	___	_____
• Machine Tool Operators	___	___	___	_____
• Welding/Soldering	___	___	___	_____
FABRICATING & ASSEMBLING				
• Foremen	___	___	___	_____
• Electrical Equipment Fabricating & Assembling	___	___	___	_____
• Electronic Equipment Fabricating & Assembling	___	___	___	_____
• Inspecting & Testing Occupations: Electronic/ Electrical Equipment	___	___	___	_____
MATERIAL HANDLING AND RELATED	___	___	___	_____
ANY OTHER OCCUPATIONS SIGNIFICANTLY AFFECTED? WHICH ONES?				
_____	___	___	___	_____
_____	___	___	___	_____
_____	___	___	___	_____

(SIC 335)

10. TRAINING/RETRAINING

These questions are about the current and future importance of **training and retraining** in your organization.

10a. Please indicate what were your firm's total training costs as a percent of total labour costs in **1981**. Record your answer on Chart 10, line 10a.

Training costs include the costs of internally or externally provided training programs, classroom and on-the-job workshops, vouchers or tuition credits, provided by your firm, which are intended to train employees to perform their jobs or to retrain employees to assume new or alternate jobs. Labour costs include all wages, salaries and benefits. (e.g., $\frac{\text{Total Training Costs}}{\text{Total Labour Costs}} \times 100 = 1.0\%$)

10b. Please indicate what your firm's total training costs as a percent of total labour costs will be in **1984** (to year end). Record your answer on line 10b.

10c. What do you estimate for **1985**, (line 10c)?

10d. What do you estimate it will be in **1990**, (line 10d)?

10e. What do you estimate it will be in **1995**, (line 10e)?

10f. For each year on Chart 10, (line 10a to 10e), please indicate what percent of total training costs in each year have or will go towards training people to adapt to the new technologies.

CHART 10

TRAINING COSTS OF FIRM

			As a Percent of Total Labour Costs	Percent of Total Training Costs Directly Related to New Technologies
10a.	1981?	Actual	___%	___%
10b.	1984?	Estimate	___%	___%
10c.	1985?	Estimate	___%	___%
10d.	1990?	Estimate	___%	___%
10e.	1995?	Estimate	___%	___%

(SIC 335)

11. FIRM'S EMPLOYMENT TRENDS

In this section, we would like to determine how the firm's employment levels in ONTARIO are likely to change over the next 10 years.

11a. To begin, considering all possible factors in your firm's internal and external environment, what is the **single most important factor** which will have an impact on your firm's level of employment in ONTARIO over the next 10 years? _____

_____

11b. The **second most important factor?** _____

_____

11c. The **third most important factor?** _____

_____

11d. Please indicate **total employees** (includes full-time, temporary, contract, casual, seasonal and part-time employment) in your organization in ONTARIO for **1971, 1981 and 1984** from your employment records. Record your answers on Chart 11, column 11d.

Please estimate future total employment in your organization in ONTARIO for **1985, 1990 and 1995.**

11e. Please indicate the **percent** of your total employment in ONTARIO that are **part-time** employees (i.e., less than normal full work week), for **1981 and 1984.** Record your answers on Chart 11, column 11e.

Also in column 11e, please estimate part-time employees as a percent of total employees in ONTARIO for **1985, 1990 and 1995.**

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11f. Please translate your total ONTARIO employment (include full-time, part-time, casual, temporary, seasonal) into a full-time equivalent (**F.T.E.**) figure for your firm for **1981 and 1984** in column 11f.

Also in column 11f, please estimate total employment in terms of a full-time equivalent (F.T.E.) for **1985, 1990 and 1995.**

By **F.T.E.** we mean a normal, full, work week for a normal, full year. F.T.E. can be measured in a variety of ways depending on whatever is normal for your firm or industry. For example, if expressed in hours of work per year one FTE might range from 1750 to 2000 hours of work a year depending on the length of the normal work week (e.g., 35 hours/week x 50 weeks = 1750 hours, 40 hours/week x 50 weeks = 2000 hours.)

CHART 11

FIRM'S EMPLOYMENT TRENDS IN ONTARIO

	11d TOTAL EMPLOYMENT IN ONTARIO	11e PART-TIME EMPLOYEES AS A % OF TOTAL EMPLOYMENT	11f TOTAL EMPLOYMENT IN FULL-TIME EQUIVALENT (F.T.E.)
Actual Figures			
1971?	_____		
1981?	_____	_____ %	_____ FTE
1984?	_____	_____ %	_____ FTE
Your Estimates			
1985?	_____	_____ %	_____ FTE
1990?	_____	_____ %	_____ FTE
1995?	_____	_____ %	_____ FTE

(SIC 335)

12. CHANGES IN EMPLOYMENT STRUCTURE

This section is intended to measure the changes in the employment structure of your firm in ONTARIO between 1981 and 1995.

12a. Please indicate the actual percentage share of <u>each</u> occupation listed as a percent of your firm's total employment in ONTARIO in **1981**. Record your answer on Chart 12, column 12a.

12b. Please indicate the actual percentage share of <u>each</u> selected occupation listed as a percent of your firm's total employment in ONTARIO in **1984**. Record your answer in column 12b.

12c. Please estimate the same for each selected occupation in **1985**. Record in column 12c.

12d. Please estimate the same for each selected occupation in **1990**. Record in column 12d.

12e. Please estimate the same for each selected occupation in **1995**. Record in column 12e.

(SIC 335)

TRENDS IN FIRM'S OCCUPATIONAL STRUCTURE
BETWEEN 1981 AND 1995

	OCCUPATIONS AS A PERCENT OF TOTAL EMPLOYMENT OF THE FIRM IN ONTARIO					
	12a Actual 1981	12b Actual 1984	12c Estimate 1985	12d Estimate 1990	12e Estimate 1995	
	%	%	%	%	%	
MANAGERIAL, ADMINISTRATIVE, & RELATED	☐	☐	☐	☐	☐	1*
NATURAL SCIENCE, ENGINEERING & MATHEMATICS	☐	☐	☐	☐	☐	2*
• Electrical Engineers	___	___	___	___	___	
• All Other Engineers	___	___	___	___	___	
• Engineering Technicians & Technologists	___	___	___	___	___	
• Systems Analysts & Computers Programmers	___	___	___	___	___	
• All Other Science & Mathematics (not listed above)	___	___	___	___	___	
PROCESSING	☐	☐	☐	☐	☐	3*
MACHINING	☐	☐	☐	☐	☐	4*
• Tool & Die Making	___	___	___	___	___	
• Machinist & Machine Tool Setting-Up	___	___	___	___	___	
• Machine Tool Operators	___	___	___	___	___	
• Welding/Soldering	___	___	___	___	___	
• All Other Machining Occupations (not listed above)	___	___	___	___	___	
FABRICATING, ASSEMBLING & REPAIRING	☐	☐	☐	☐	☐	5*
• Foremen	___	___	___	___	___	
• Electrical Equipment Fabricating & Assembling	___	___	___	___	___	
• Electronic Equipment Fabricating & Assembling	___	___	___	___	___	
• Inspecting & Testing Occupations: Electronic/Electrical Equipment	___	___	___	___	___	
• All Other Fabricating, Assembling, & Repair (not listed above)	___	___	___	___	___	
MATERIAL HANDLING AND RELATED	☐	☐	☐	☐	☐	6*
ALL OTHER OCCUPATIONS	☐	☐	☐	☐	☐	7*
* FIRM'S TOTAL EMPLOYMENT IN ONTARIO (1+2+3+4+5+6+7 = 100%)	100%	100%	100%	100%	100%	

13. EMPLOYMENT STRUCTURE BY SEX

The following questions refer to your firm's employment in ONTARIO **by sex** for each specific occupation listed in Chart 13.

13a. Please provide the percentage split between male and female of your employees in ONTARIO **by each occupation in 1981.** Record your answer on Chart 13, column 13a.

13b. Please provide the percentage split between male and female employees by occupation in ONTARIO in **1984.** Record your answer in Column 13b.

(SIC 335)

CHART 13

EMPLOYMENT STRUCTURE BY SEX AND OCCUPATION IN ONTARIO

	13a 1981 EMPLOYMENT MALE	FEMALE	TOTAL	13b 1984 EMPLOYMENT MALE	FEMALE	TOTAL
MANAGERIAL, ADMINISTRATIVE & RELATED	___% +	___%	=100%	___% +	___%	=100%
NATURAL SCIENCE, ENGINEERING & MATHEMATICS						
• Electrical Engineers	___% +	___%	=100%	___% +	___%	=100%
• All Other Engineers	___% +	___%	=100%	___% +	___%	=100%
• Engineering Technicians & Technologists	___% +	___%	=100%	___% +	___%	=100%
• Systems Analysts & Computer Programmers	___% +	___%	=100%	___% +	___%	=100%
PROCESSING	___% +	___%	=100%	___% +	___%	=100%
MACHINING						
• Tool & Die Making	___% +	___%	=100%	___% +	___%	=100%
• Machinist & Machine Tool Setting-Up	___% +	___%	=100%	___% +	___%	=100%
• Machine Tool Operators	___% +	___%	=100%	___% +	___%	=100%
• Welding/Soldering	___% +	___%	=100%	___% +	___%	=100%
FABRICATING, ASSEMBLING & REPAIRING						
• Foremen	___% +	___%	=100%	___% +	___%	=100%
• Electrical Equipment Fabricating & Assembling	___% +	___%	=100%	___% +	___%	=100%
• Electronic Equipment Fabricating & Assembling	___% +	___%	=100%	___% +	___%	=100%
• Inspecting & Testing Occupations: Electronic/ Electrical Equipment	___% +	___%	=100%	___% +	___%	=100%
MATERIAL HANDLING AND RELATED	___% +	___%	=100%	___% +	___%	=100%
FIRM'S TOTAL EMPLOYEES IN ONTARIO	___% +	___%	=100%	___% +	___%	=100%

14. ORGANIZED LABOUR IN YOUR FIRM IN ONTARIO

14a. Does your firm have any workers in ONTARIO covered by a collective labour agreement(s)?

Yes ☐ No ☐ **If no, go on to Question 14c.**

14b. If yes, what percent of your firm's total employment in ONTARIO is currently (1984) unionized?

_____%

14c. What percent of your firm's total employment in ONTARIO do you estimate will be unionized by 1985, 1990 and by 1995?

- 1985? _____%
- 1990? _____%
- 1995? _____%

14d. If you expect an increase in the percent of total employment that will be unionized, please indicate the specific occupational groups within which you expect the increase will take place.

_____

_____

15. ORGANIZED LABOUR AND TECHNOLOGY CHANGE

If any of the employees in your firm in ONTARIO are represented by a union, please answer the following series of questions. If none of the workers in your firm in ONTARIO are unionized, please go on to Question 16, p. 22.

15a. Please indicate the name of the union(s) in your firm in ONTARIO. Record your answers on Chart 15, on line 15a.

15b. On line 15b, please indicate the number of the firm's employees in ONTARIO in each union.

15c. On line 15c, indicate the worker groups in your firm the union(s) represents.

15d. On line 15d, check ☑ if the contract(s) has a technology change clause(s).

15e. On line 15e, check ☑ if the technology change clause(s) covers any of the following:

- Notice/Disclosure
- Consultation/Participation
- Joint Technology Change Committee
- Job Security
- Seniority
- Other (please specify).

15f. On line 15f, indicate whether the clause(s) is effectively administered. If your answer is "NO", please explain your answer.

CHART 15

ORGANIZED LABOUR IN ONTARIO

	(name of union)	(name of union)	(name of union)
15a. Name of Unions in Firm			
15b. Number of Firm's Employees in Each Union			
15c. Worker Groups Represented by Each Union			
15d. Does Union(s) Contract(s) Have a Technology Change Clause(s)?			
YES	☐	☐	☐
NO	☐	☐	☐
15e. Check ☑ if Technology Change Clause(s) Includes:			
• Notice/Disclosure	☐	☐	☐
• Consultation/Participation	☐	☐	☐
• Joint Technology Change Committee	☐	☐	☐
• Job Security	☐	☐	☐
• Seniority	☐	☐	☐
• Other _____ (specify)	☐	☐	☐
15f. Is the Clause Effectively Administered?			
YES	☐	☐	☐
NO	☐	☐	☐
If 'NO', explain			

(SIC 321)

15g. In general, what has been the union's position on the adoption of new technologies in your firm? Please explain.

_____

_____

_____

_____

_____

(SIC 335)

16. THE NATURE OF WORKER INVOLVEMENT IN THE PROCESS OF TECHNOLOGY ADOPTION

The following questions are on the nature of the **relationship between workers and management** in your firm as decisions are made on the adoption of new technology.

16a. Does your firm have a formal mechanism for worker participation in any of the following? Please Check ☑ Yes or No

	YES	NO
• Setting production and/or sales targets:		
- at company level?	☐	☐
- at division/plant level?	☐	☐
- at department/area level?	☐	☐
- at working group level?	☐	☐
• Improving productivity/quality?	☐	☐
• Adoption of new technology?	☐	☐

16b. In your opinion, to what extent and how should management involve workers in decisions regarding the adoption of new technologies? Please comment.

_____

_____

_____

_____

_____

_____

17. FUTURE CAPITAL INVESTMENTS

17a. Please indicate how much, **in today's dollars**, your firm plans to spend on **construction of structures and buildings** in ONTARIO over the period **1985 to 1990** and over the period **1991 to 1995**. Record your answer on Chart 17, column 17a.

17b. What percent of this spending can be directly attributed to the adoption of **new technologies**? Record under column 17b.

17c. Would you indicate how much, **in today's dollars**, your firm plans to spend on **machinery and equipment** over the period 1985 to 1990 and over the period **1991 to 1995** in ONTARIO. Record under column 17c.

17d. What percent of this spending on **machinery and equipment** will be for **new technologies**? Record under column 17d.

17e. Please indicate what criterion your firm will likely use to justify the financial investment in the new technologies.

Pay-back period ☐ _____
If Yes, how long?

Return on investment ☐ _____
If Yes, what rate?

Other _____ ☐ _____
(specify) Please elaborate

17f. Considering now your total capital investment in new technology over the next 10 years, what percent will be funded through internal funds and what percent will be funded through external funds?

Internal funds ___%
External funds ___%
100%

(SIC 335)

CHART 17

CAPITAL INVESTMENT PLANS
IN ONTARIO

	INVESTMENT IN STRUCTURES & BUILDINGS		INVESTMENT IN MACHINERY & EQUIPMENT	
	17a	17b	17c	17d
	IN TODAY'S DOLLARS (In Thousands $)	% DIRECTLY RELATED TO NEW TECHNOLOGY	IN TODAY'S DOLLARS (In Thousands $)	% FOR NEW TECHNOLOGY
1985 to 1990?	$_____	_____%	$_____	_____%
1991 to 1995?	$_____	_____%	$_____	_____%

(SIC 321)

18. PLANNING FOR CHANGES IN TECHNOLOGY

These questions ask about your firm's plans for adopting new technologies in ONTARIO.

18a. Does your firm currently have a long-term strategic plan?

Yes ☐ No ☐

18b. Does your firm have a plan to deal with future human resource needs?

Yes ☐ No ☐ **If no, go to Question 18d.**

18c. Up to what year has your firm planned for its human resource needs?

_____

(WRITE IN YEAR)

18d. Does your firm have a capital investment plan dealing with the adoption of new technologies?

Yes ☐ No ☐ **If no, go to Question 19. on p. 25.**

18e. Up to what year has your firm planned for its capital requirements?

_____

(WRITE IN YEAR)

18f. On a scale of 1 to 5, please indicate to what extent these two plans (capital investment and human resource plans) are integrated.

(Please circle answer)

NOT AT ALL INTEGRATED	1	2	3	4	5	HIGHLY INTEGRATED

(SIC 335)

19. Please indicate below any other comments on the issue of employment and new technology you wish to make.

_____

_____

_____

_____

_____

_____

_____

_____

THANK YOU FOR YOUR PARTICIPATION

(SIC 335)

COMMUNICATIONS EQUIPMENT MANUFACTURERS

Number of Firms and Unions Responding by Question

Question		Firms	Unions	Question		Firms	Unions
Question 1	1982-1983	9	0	Question 12	a,b,c,d,e	11	0
	1983-1984	9	1				
	1984-1985	9	0				
	1985-1990	10	0	Question 13		*	*
	1990-1995	10	0				
Question 2		*	*	Question 14	a	12	2
					b	7	1
					c	12	0
Question 3	a,b,c	12	1		d	0	1
Question 4	a,b,c	12	1	Question 15	a	4	2
					b	3	2
					c	*	*
Question 5	a,b,c	12	2		d	4	2
					e	3	2
					f	2	1
Question 6	a,b	11	2		g	4	2
Question 7	a	10	1	Question 16	a	12	2
	b	8	1		b	10	2
Question 8	a	11	1	Question 17	a	10	0
	b	8	1		b	10	0
					c	11	0
					d	11	0
Question 9	a	10	1		e	12	0
	b	10	1		f	12	0
	c	10	1				
				Question 18	a	12	1
Question 10	a,b,c,d,e	9	0		b	12	1
					c	7	0
Question 11	a,b,c,	12	1		d	12	1
	d	11	0		e	10	0
	e	11	0		f	9	0
	f	11	0				

* Data not used and therefore, number of responses not reported.

APPENDIX C

RELIABILITY OF THE SAMPLE

SAMPLE RELIABILITY

The sample reliability is summarized with other sample and population characteristics in "Table 1". The sample was selected as a three stage stratified random sample. The purpose of this stratification was to reduce the error variance in the measurement of organization size by increasing the homogeneity of each group of organizations within each strata.

The first stage consisted in creating two industry sectors (i.e. manufacturing and services). The second stage involved dividing up each industry sector into nine and fourteen industrial sub-classes respectively and according to Standard Industrial Classification codes (see Table 1). The third stage was to further stratify each SIC into three more homogeneous size groups:

Manufacturing Sector		Service Sector
Small	20- 99 employees	20-199 employees
Medium	100-499 employees	200-999 employees
Large	500+ employees	1,000+ employees

Exceptions to these three size groupings are as follows:

SECTOR		ORGANIZATION SIZE EXCLUSION
Manufacturing Sector		
291	Iron & Steel Mills	less than 500
321	Aircraft & Aircraft Parts	less than 50
Service Sector		
701	Banks and Trusts	less than 50
721	General and Life Insurance	less than 50
735	Insurance Brokers	less than 50
909	Federal Government	less than 500
931	Provincial Government	less than 200
951	Local Government	less than 500

Overall, the sample yields a relatively high reliability level in reflecting the employment level of those sectors surveyed. For instance for the Communications Equipment Industry the sample yields a minimum confidence level of about 90 percent with an associated allowable error of 11 percent. That is, we would expect that the estimated employment level for the sector has a 90 percent chance of being within $\pm$ 11 percent of the actual employment level found in the frame. Or stated alternatively, if 100 independent random samples were drawn, in 90 of these samples we would expect to have an estimated employment level within $\pm$ 11 percent of the actual employment level found in the sample frame.

TABLE 1: SUMMARY OF MANUFACTURING INDUSTRIES

SAMPLE FRAME AND SAMPLE

		UNIVERSE		SAMPLE FRAME				SAMPLE				
Code	SIC NAME	Number of Firms	Number of Employees[1]	Min. Size Cut Off	Number of Firms	Number of Employees[2]	Share of Universe	Number of Firms	Number of Unions	Number of Employees	Reliability Level (min.)	Allowable Error
											Percent	
31	Iron and Steel Mills	17	41,603	500	7	39,900	96	3	1	21,833	90	23
34	Metal Stamping, Pressing and Coating Industry	185	17,730	20	145	17,200	97	14	3	4,507	99	5
36	Hardware, Tool and Cutlery Manufacturing	225	12,826	20	135	11,500	90	11	6	1,489	94	5
39	Miscellaneous Metal Fabricating Industries	132	12,235	20	110	12,000	98	11	6	2,694	99	5
35	Miscellaneous Machinery and Equipment Manufacturers	304	36,904	20	262	36,500	99	12	3	3,972	99	5
38	Office and Store Machinery Manufacturers	29	10,485	20	29	9,800	93	7	0	11,814	99	5
35	Communications Equipment Manufacturers	67	28,090	20	65	27,800	99	12	2	14,946	90	11
31	Aircraft and Aircraft Parts Manufacturers	22	12,732	50	17	12,000	94	10	5	11,737	95	7
35	Plastic Processing	196	19,218	20	169	18,800	98	13	4	2,400	99	5
								92	28			

Source: Census of Manufacturing, 1982, Statistics Canada, Catalogue No. 31-203.

Rounded to nearest 100.

APPENDIX D

HISTORICAL TABLES

TABLE D1

MAJOR PRODUCTS OF THE CANADIAN COMMUNICATIONS EQUIPMENT INDUSTRY

	Value of Shipments In 1981 ($ Millions)	Percent of Total Shipments
Telephone equipment	668.6	24.0
Electronic equipment components	253.7	9.1
Radio communication equipment	245.9	8.8
Miscellaneous electric and electronic equipment	124.6	4.5
Contract maintenance of electronic equipment	92.2	3.3
Radar equipment	77.3	2.8
Sonar equipment	41.0	1.5
Broadcast studio equipment	28.1	1.0
All other products *	1,255.2	45.0
TOTAL	2,786.5	100.0

* Includes adjustments and estimate for small establishments not reporting in detail.

NOTE: Details may not add to totals due to rounding.

SOURCE: Statistics Canada, Communications Equipment Industry, Cat. No. 43-206.

TABLE D2

COMMUNICATIONS EQUIPMENT MANUFACTURERS (SIC 335)
ONTARIO
1971 - 1984
Current Dollars

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
ESTABLISHMENTS (Number)	150	143	140	159	160	161	153	187	215	227	238	263		
CAPACITY UTILIZATION RATE, CANADA	83.8	86.8	93.4	93.9	82.0	81.1	77.1	76.9	84.5	81.9	83.9	70.8	69.0	
OUTPUT ($ Million)														
MANUFACTURING SHIPMENTS	426.9	483.2	615.9	800.8	826.4	862.4	932.5	986.1	1148.4	1426.1	1711.8	1819.2		
MANUFACTURING VALUE ADDED	237.5	295.7	393.9	475.8	506.7	534.2	585.9	643.6	746.3	851.0	1052.8	1122.3		
WAGES & SALARIES	165.8	164.2	214.2	260.6	268.7	281.4	311.1	348.1	424.6	487.9	565.2	631.0		
EMPLOYMENT (Number)														
PRODUCTION WORKERS	14,987	14,105	17,149	18,101	16,560	15,804	14,176	15,274	15,409	17,553	19,236	18,513		
ADMINISTRATIVE STAFF	8,070	7,505	8,987	9,512	8,081	7,188	8,794	8,625	8,821	9,067	8,823	9,577		
TOTAL	23,057	21,610	26,136	27,613	24,641	22,992	22,970	23,899	24,230	26,620	28,059	28,090		
CAPITAL INVESTMENT, CANADA ($ Million)														
CONSTRUCTION	3.1	3.4	10.7	10.1	8.2	10.7	8.0	2.6	9.6	17.7	53.1	39.1	61.8	37.5
MACHINERY & EQUIPMENT	24.0	21.4	27.2	35.5	33.7	36.2	35.9	40.0	55.2	100.0	132.0	139.1	188.1	234.3
TOTAL	27.1	24.8	37.9	45.6	41.9	46.9	43.9	42.6	64.8	117.7	185.1	178.2	249.9	271.8
COMPETITIVENESS														
VALUE ADDED/EMPLOYEE (Dollars)	10,302	13,683	15,070	17,231	20,561	23,235	25,506	26,928	30,802	31,969	37,519	39,954		
VALUE ADDED/$ LABOUR	1.43	1.80	1.84	1.83	1.89	1.90	1.88	1.85	1.76	1.74	1.86	1.78		
VALUE ADDED/$ LABOUR (United States)	1.67	1.72	1.78	1.82	1.81	1.93	2.02	2.00	2.04	2.09	2.04	2.08		
EXPORTS ($ Million)	108.2	106.9	152.9	206.0	186.5	197.2	191.3	290.2	414.9	555.3	712.0	802.2	820.8	
IMPORTS ($ Million)	187.6	243.9	328.2	385.3	335.6	408.8	463.6	561.9	785.3	919.3	1,091.3	1,064.5	1,264.3	
TRADE BALANCE ($ Million)	(79.5)	(137.0)	(175.3)	(179.3)	(149.1)	(211.6)	(272.3)	(271.8)	(370.4)	(363.9)	(379.3)	(262.3)	(443.5)	
NORMALIZED TRADE BALANCE	(0.269)	(0.391)	(0.364)	(0.303)	(0.286)	(0.349)	(0.416)	(0.319)	(0.309)	(0.247)	(0.210)	(0.141)	(0.213)	

( ) indicates deficit

NOTE: Capacity Utilization Rate shown is for Total Electrical Products industries.

SOURCE: Statistics Canada, MANUFACTURING INDUSTRIES OF CANADA: NATIONAL AND PROVINCIAL AREAS, Cat. No. 31-203; CAPACITY UTILIZATION RATES IN CANADIAN MANUFACTURING, Cat. No. 31-003; and External Trade Division, Special Runs. United States data supplied by Coopers & Lybrand. Calculations by Economics Practice, Currie, Coopers & Lybrand.

TABLE D3

COMMUNICATIONS EQUIPMENT MANUFACTURERS (SIC 335)
ONTARIO
1971 - 1984
PER CENT CHANGE
Current Dollars

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
ESTABLISHMENTS (Number)	-4.7	-2.1	13.6	0.6	0.6	-5.0	22.2	15.0	5.6	4.8	10.5		
OUTPUT ($ Million)													
MANUFACTURING SHIPMENTS	13.2	27.5	30.0	3.2	4.4	8.1	5.7	16.5	24.2	20.0	6.3		
MANUFACTURING VALUE ADDED	24.5	33.2	20.8	6.5	5.4	9.7	9.8	16.0	14.0	23.7	6.6		
WAGES & SALARIES	-1.0	30.4	21.6	3.1	4.7	10.5	11.9	22.0	14.9	15.8	11.6		
EMPLOYMENT (Number)													
PRODUCTION WORKERS	-5.9	21.6	5.6	-8.5	-4.6	-10.3	7.7	0.9	13.9	9.6	-3.8		
ADMINISTRATIVE STAFF	-7.0	19.7	5.8	-15.0	-11.1	22.3	-1.9	2.3	2.8	-2.7	8.5		
TOTAL	-6.3	20.9	5.7	-10.8	-6.7	-0.1	4.0	1.4	9.9	5.4	0.1		
CAPITAL INVESTMENT, CANADA ($ Million)													
CONSTRUCTION	9.7	214.7	-5.6	-18.8	30.5	-25.2	-67.5	269.2	84.4	200.0	-26.4	58.1	-39.3
MACHINERY & EQUIPMENT	-10.8	27.1	30.5	-5.1	7.4	-0.8	11.4	38.0	81.2	32.0	5.4	35.2	24.6
TOTAL	-8.5	52.8	20.3	-8.1	11.9	-6.4	-3.0	52.1	81.6	57.3	-3.7	40.2	8.8
COMPETITIVENESS													
VALUE ADDED/EMPLOYEE	32.8	10.1	14.3	19.3	13.0	9.8	5.6	14.4	3.8	17.4	6.5		
EXPORTS	-1.2	43.0	34.7	-9.5	5.7	-3.0	51.7	43.0	33.9	28.2	12.7	2.3	
IMPORTS	30.0	34.6	17.4	-12.9	21.8	13.4	21.2	39.7	17.1	18.7	-2.5	18.8	

SOURCE: Calculated from Table D2 by Economics Practice, Currie, Coopers & Lybrand. Calculations based on unrounded data where available.

TABLE D4

COMMUNICATIONS EQUIPMENT MANUFACTURERS (SIC 335)
ONTARIO
1971 - 1984
Constant 1971 Dollars

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
ESTABLISHMENTS (Number)	150	143	140	159	160	161	153	187	215	227	238	263		
CAPACITY UTILIZATION RATE, CANADA	83.8	86.8	93.4	93.9	82.0	81.1	77.1	76.9	84.5	81.9	83.9	70.8	69.0	
OUTPUT ($ Million)														
MANUFACTURING SHIPMENTS	426.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	606.4	688.9	832.5	950.5	976.0		
MANUFACTURING VALUE ADDED	237.5	243.8	316.1	374.9	331.6	321.4	320.5	332.4	351.9	373.4	410.8	376.4		
WAGES & SALARIES	165.8	157.9	191.9	209.8	195.7	189.5	193.8	201.6	225.0	233.6	242.2	243.8		
EMPLOYMENT (Number)														
PRODUCTION WORKERS	14,987	14,105	17,149	18,101	16,560	15,804	14,176	15,274	15,409	17,553	19,236	18,513		
ADMINISTRATIVE STAFF	8,070	7,505	8,987	9,512	8,081	7,188	8,794	8,625	8,821	9,067	8,823	9,577		
TOTAL	23,057	21,610	26,136	27,613	24,641	22,992	22,970	23,899	24,230	26,620	28,059	28,090		
CAPITAL INVESTMENT CANADA ($ Million)														
CONSTRUCTION	3.1	3.2	9.4	7.6	5.5	6.7	4.7	1.4	4.8	8.0	21.4	14.4	21.7	12.8
MACHINERY & EQUIPMENT	24.0	20.9	25.4	29.1	24.2	24.6	22.4	22.4	28.1	46.1	54.5	53.2	69.8	82.6
TOTAL	27.1	24.1	34.8	36.7	29.7	31.3	27.1	23.8	32.9	54.1	75.9	67.6	91.5	95.4
COMPETITIVENESS														
VALUE ADDED/EMPLOYEE (Dollars)	10,302	11,280	12,095	13,578	13,456	13,980	13,953	13,909	14,522	14,028	14,639	13,398		

n.a. - Not available as the Industry Selling Price Index is secured, 1972 to 1977, to meet secrecy requirements of the Statistics Act.

NOTE: Calculations based on unrounded data where available. Shipments data deflated by the Industry Selling Price Index for SIC 335; Value Added deflated by the Implicit Price Index for Gross Domestic Product for SIC 335; Wages and Salaries deflated by the Implicit Price Index for Personal Expenditure on Consumer Goods and Services; and Capital Investment deflated by the Implicit Price Indexes for Business Non-Residential Construction and Machinery and Equipment.

SOURCE: Publications as outlined in Table D1. Also Statistics Canada, INDUSTRY PRICE INDEXES, Cat. No. 62-011; GROSS DOMESTIC PRODUCT BY INDUSTRY, Cat. No. 61-005; and NATIONAL INCOME AND EXPENDITURE ACCOUNTS, Cat. No. 13-201. Calculations and forecast deflators by Economics Practice, Currie, Coopers & Lybrand.

TABLE D5

COMMUNICATIONS EQUIPMENT MANUFACTURERS (SIC 335)
ONTARIO
1971 - 1984
PER CENT CHANGE
Constant 1971 Dollars

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
ESTABLISHMENTS (Number)	-4.7	-2.1	13.6	0.6	0.6	-5.0	22.2	15.0	5.6	4.8	10.5		
OUTPUT ($ Million)													
MANUFACTURING SHIPMENTS	-	-	-	-	-	-	-	13.6	20.8	14.2	2.7		
MANUFACTURING VALUE ADDED	2.6	29.7	18.6	-11.6	-3.1	-0.3	3.7	5.9	6.1	10.0	-8.4		
WAGES & SALARIES	-4.8	21.5	9.3	-6.7	-3.2	2.3	4.0	11.6	3.8	3.7	0.7		
EMPLOYMENT (Number)													
PRODUCTION WORKERS	-5.9	21.6	5.6	-8.5	-4.6	-10.3	7.7	0.9	13.9	9.6	-3.8		
ADMINISTRATIVE STAFF	-7.0	19.7	5.8	-15.0	-11.1	22.3	-1.9	2.3	2.8	-2.7	8.5		
TOTAL	-6.3	20.9	5.7	-10.8	-6.7	-0.1	4.0	1.4	9.9	5.4	0.1		
CAPITAL INVESTMENT, CANADA ($ Million)													
CONSTRUCTION	3.2	193.8	-19.1	-27.6	21.8	-29.9	-70.2	242.9	66.7	167.5	-32.7	50.7	-41.0
MACHINERY & EQUIPMENT	-12.9	21.5	14.6	-16.8	1.7	-8.9	0.0	25.4	64.1	18.2	-2.4	31.2	18.4
TOTAL	-11.1	44.4	5.5	-19.1	5.4	-13.4	-12.2	38.2	64.4	40.3	-10.9	35.4	4.3
COMPETITIVENESS													
VALUE ADDED/EMPLOYEE	9.5	7.2	12.3	-0.9	3.9	-0.2	-0.3	4.4	-3.4	4.4	-8.5		

SOURCE: Calculated from Table D4 by Economics Practice, Currie, Coopers & Lybrand. Calculations based on unrounded data where available.

TABLE D6

OCCUPATIONAL INDICATORS: COMMUNICATIONS EQUIPMENT MANUFACTURERS

RANKING BY RELATIVE STRENGTH

	NUMBER OF EMPLOYEES 1981	AVERAGE ANNUAL RATE OF CHANGE PERCENT, 1971-1981
I. TOTAL INDUSTRY	30,010	2.8
II. TWO DIGIT LEVEL		
MATERIAL HANDLING AND RELATED	310	(1.9)
PROCESSING	305	(1.8)
MACHINING AND RELATED	1,725	(1.1)
PRODUCT FABRICATING, ASSEMBLING AND REPAIRING	10,830	2.8
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS	5,395	5.3
MANAGERIAL, ADMINISTRATIVE AND RELATED	3,030	10.8
III. FOUR DIGIT LEVEL		
MATERIAL HANDLING AND RELATED		
Packaging, n.e.c.	150	(4.2)
TOTAL	310	(1.9)
PROCESSING		
Metal Processing and Related, n.e.c.	110	10.6
TOTAL	305	(1.8)
MACHINING AND RELATED		
Machine-Tool Operating	200	(3.0)
Welding and Flame Cutting	555	(1.7)
Tool- and Die-Making	180	(1.5)
Machinist and Machine-Tool Setting-Up	375	2.1
TOTAL	1,725	(1.1)
PRODUCT FABRICATING, ASSEMBLING AND REPAIRING		
Electrical Equipment Fabricating and Assembling	1,025	(5.5)
Fabricating, Assembling, Installing and Repairing: Electrical, Electronic and Related, n.e.c.	135	(3.4)
Labouring and Other Elemental Work: Fabricating, Assembling, Installing and Repairing, Electrical, Electronic and Related	225	(2.2)

TABLE D6 (Cont'd)

OCCUPATIONAL INDICATORS: COMMUNICATIONS EQUIPMENT MANUFACTURERS

RANKING BY RELATIVE STRENGTH

	NUMBER OF EMPLOYEES 1981	AVERAGE ANNUAL RATE OF CHANGE PERCENT, 1971-1981
PRODUCT FABRICATING, ASSEMBLING AND REPAIRING (Cont'd)		
Radio and Television Service Repairmen	185	0.0
Foremen: Fabricating, Assembling, Installing and Repairing, Electrical, Electronic and Related	905	1.2
Electrical and Related Equipment Installing and Repairing, n.e.c.	175	2.6
Inspecting and Testing: Fabricating, Assembling, Installing, and Repairing, Electrical and Electronic and Related Equipment	1,850	4.5
Electronic Equipment Fabricating and Assembling	4,760	6.0
Industrial, Farm and Construction Machinery Mechanics and Repairmen	145	6.1
Electronic and Related Equipment Installing and Repairing, n.e.c.	830	16.5
TOTAL	10,830	2.8
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS		
Mechanical Engineers	105	0.5
Industrial Engineers	520	2.2
Architectural and Engineering Technologists and Technicians	1,840	5.2
Draughtsmen	455	6.2
Electrical Engineers	1,620	6.2
Systems Analysts, Computer Programmers and Related	535	10.9
Supervisors, Other Occupations in Architecture and Engineering	125	13.6
TOTAL	5,395	5.3

TABLE D6 (Cont'd)

OCCUPATIONAL INDICATORS: COMMUNICATIONS EQUIPMENT MANUFACTURERS

RANKING BY RELATIVE STRENGTH

	NUMBER OF EMPLOYEES 1981	AVERAGE ANNUAL RATE OF CHANGE PERCENT, 1971-1981
MANAGERIAL, ADMINISTRATIVE AND RELATED		
Occupations Related to Management and Administration, n.e.c.	220	0.7
Purchasing Officers and Buyers, Except Wholesale and Retail Trade	245	4.4
Personnel and Related Officers	100	5.2
Accountants, Auditors and Other Financial Officers	405	5.6
General Managers and Other Senior Officials	250	9.6
Other Managers and Administrators, n.e.c.	205	13.1
Management: Natural Sciences, Engineering and Mathematics	180	13.7
Management, Transport and Communications Operations	130	17.9
Sales and Advertising Management	375	18.3
Production Management	625	22.8
Personnel and Industrial Relations Management	130	38.5
TOTAL	3,030	10.8

() Indicates decline.

NOTE: Figures do not add to totals as all occupations are not included.

SOURCE: Census data, Ontario Ministry of Labour.

TABLE D7

OCCUPATIONAL INDICATORS: COMMUNICATIONS EQUIPMENT MANUFACTURERS

RANKING BY INCREASE IN FEMALE REPRESENTATION

	FEMALES EMPLOYED 1981	FEMALE EMPLOYMENT AS A PERCENT OF TOTAL 1971	1981	NUMBER OF JOBS GAINED BY FEMALES 1971-1981
I. TOTAL INDUSTRY	12,755	41.6	42.5	3,270
II. TWO DIGIT LEVEL				
MACHINING AND RELATED	705	41.3	40.9	(90)
MATERIAL HANDLING AND RELATED	120	45.3	38.7	(65)
PROCESSING	115	45.2	37.7	(50)
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS	470	7.1	8.7	240
MANAGERIAL, ADMINISTRATIVE AND RELATED	465	10.6	15.3	350
PRODUCT FABRICATING, ASSEMBLING AND REPAIRING	6,390	60.3	59.0	1,445
III. FOUR DIGIT LEVEL				
MACHINING AND RELATED	450	78.8	81.1	(70)
Welding and Flame Cutting	50	22.2	25.0	(10)
Machine-Tool Operating	0	2.4	0.0	(5)
Tool- and Die-Making	40	14.8	10.7	(5)
Machinist and Machine-Tool Setting-Up				
TOTAL	705	41.3	40.9	(90)
MATERIAL HANDLING AND RELATED	85	63.0	56.7	(60)
Packaging, n.e.c.				
TOTAL	120	45.3	38.7	(65)
PROCESSING	35	75.0	31.8	5
Metal Processing and Related, n.e.c.				
TOTAL	115	45.2	37.7	(50)

TABLE D7 (Cont'd)

OCCUPATIONAL INDICATORS: COMMUNICATIONS EQUIPMENT MANUFACTURERS

RANKING BY INCREASE IN FEMALE REPRESENTATION

	FEMALES EMPLOYED 1981	FEMALE EMPLOYMENT AS A PERCENT OF TOTAL 1971	1981	NUMBER OF JOBS GAINED BY FEMALES 1971-1981
NATURAL SCIENCES, ENGINEERING AND MATHEMATICS				
Supervisors, Other Occupations in Architecture and Engineering	0	14.3	0.0	(5)
Mechanical Engineers	0	0.0	0.0	0
Electrical Engineers	20	1.1	1.2	10
Industrial Engineers	35	6.0	6.7	10
Draughtsmen	110	12.0	24.2	80
Architectural and Engineering Technologists and Technicians	150	5.0	8.2	95
Systems Analysts, Computer Programmers and Related	125	15.8	23.4	95
TOTAL	470	7.1	8.7	240
MANAGERIAL, ADMINISTRATIVE AND RELATED				
General Managers and Other Senior Officials	0	0.0	0.0	0
Management, Transport and Communications Operations	5	0.0	3.8	5
Management: Natural Sciences, Engineering and Mathematics	15	0.0	8.3	15
Other Managers and Administrators, n.e.c.	50	58.3	24.4	15
Sales and Advertising Management	20	0.0	5.3	20
Accountants, Auditors and Other Financial Officers	70	19.1	17.3	25
Personnel and Industrial Relations Management	40	0.0	30.8	40
Production Management	50	6.3	8.0	45
Purchasing Officers and Buyers, Except Wholesale and Retail Trade	60	9.4	24.5	45
Personnel and Related Officers	60	16.7	60.0	50
Occupations Related to Management and Administration, n.e.c.	55	0.0	25.0	55
TOTAL	465	10.6	15.3	350

TABLE D7 (Cont'd)

OCCUPATIONAL INDICATORS: COMMUNICATIONS EQUIPMENT MANUFACTURERS

RANKING BY INCREASE IN FEMALE REPRESENTATION

	FEMALES EMPLOYED 1981	FEMALE EMPLOYMENT AS A PERCENT OF TOTAL 1971	1981	NUMBER OF JOBS GAINED BY FEMALES 1971-1981
PRODUCT FABRICATING, ASSEMBLING AND REPAIRING				
Electrical Equipment Fabricating and Assembling	730	74.8	71.2	(620)
Labouring and Other Elemental Work: Fabricating, Assembling, Installing, Repairing, Electrical, Electronic and Related Equipment	135	76.8	60.0	(80)
Fabricating, Assembling, Installing and Repairing: Electrical, Electronic and Related Equipment, n.e.c.	60	44.7	44.4	(25)
Radio and Television Service Repairmen	15	16.2	8.1	(15)
Industrial, Farm and Construction Machinery Mechanics and Repairmen	5	6.3	3.4	0
Electrical and Related Equipment Installing and Repairing, n.e.c.	30	18.5	17.1	5
Foremen: Fabricating Assembling, Installing and Repairing, Electrical, Electronic and Related Equipment	205	14.3	22.7	90
Electronic and Related Equipment Installing and Repairing, n.e.c.	275	13.9	33.1	250
Inspecting and Testing: Fabricating, Assembling, Installing and Repairing, Electrical, Electronic and Related Equipment	975	59.2	52.7	270
Electronic Equipment Fabricating and Assembling	3,725	82.0	78.3	1,545
TOTAL	6,390	60.3	59.0	1,445

() Indicates decline.

NOTE: Figures do not add to totals as all occupations are not included.

SOURCE: Census data, Ontario Ministry of Labour

FINAL REPORT AND APPENDICES OF THE ONTARIO TASK FORCE ON EMPLOYMENT AND NEW TECHNOLOGY

Final Report — Employment and New Technology

Appendices:

1. Labour Market Trends in Ontario, 1950-1980
2. Occupational Employment Trends in Ontario, 1971-1981
3. Emerging New Technology, 1985-95: Framework for a Survey of Firms
4. Employment and New Technology in Ontario's Manufacturing Sector: A Summary of Selected Industries
5. Employment and New Technology in the Iron and Steel Industry
6. Employment and New Technology in the Metal Fabricating Industry
7. Employment and New Technology in the Machinery and Equipment Industry
8. Employment and New Technology in the Aircraft and Aircraft Parts Industry
9. Employment and New Technology in the Communications Equipment Industry
10. Employment and New Technology in the Office, Store and Business Machine Industry
11. Employment and New Technology in the Plastic Processing Industry
12. Employment and New Technology in Ontario's Service Sector: A Summary of Selected Industries
13. Employment and New Technology in the Chartered Banks and Trust Industry
14. Employment and New Technology in the Insurance Industry
15. Employment and New Technology in the Government Services Industry
16. Employment and New Technology in the Telecommunications Industry
17. Employment and New Technology in the Retail Trade Industry
18. Employment and New Technology in the Computer Services and Management Consulting Industry
19. Industry-Sector and Occupational Employment in Ontario, 1985-1995
20. Technological Change, Productivity, and Employment: Studies of the Overall Economy


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